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New Benchmarks Poster ● Microsoft Demo Disk ● See reverse side for full details

THERE ARE A PILE OF REASONS FOR NOT GETTING A DESKTOP PUBLISHER

One is that you can get Expression™ from Canon for only $14,950.*

Expression can be used by any business that would like to save money on small print runs, or make money with better documents, overheads and presentations. Or both. Expression creates pictures, changes type sizes, faces and weights, and prints everything on a laser beam printer in as little as 15 seconds.

Expression is a package of hardware, software, operating commands and training designed to overcome the problems of most conventional DTP systems. At a price that puts them to shame.

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Ever tried to piece together a DTP system? You need a PC, printer, scanner, and typefaces, all compatible of course. Add to that word processing, graphics, editing and file manipulation packages. Then, if you're really serious, tart it up with all kinds of other software. Next, you have to sort through conflicting claims and brochures, and organise training programmes for the different pieces. Then you need a secretary conversant in the PC operating system, a master of several software command languages and a layout artist to boot!

Take this approach, and you may pay heaps for a slow, inefficient method of obtaining mediocre results. And if your secretary ever leaves, you don't even want to know about re-training.

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The layout mode makes life simple for the beginner. Commonly used graphics, style sheets and formats are already included. Changing from one routine to another is extraordinarily simple because the command language never varies. In fact, if the system weren't so powerful, we'd be tempted to describe it as word processing with pictures.

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Just give us, or a Canon dealer, a call. We'll arrange for a demo immediately. Because once you've seen it, we think you'll agree that there are many more reasons to get Expression than a pieced-together DTP system.

†IBM is a trademark of International Business Machines Corporation
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Canon

CONTENTS

Guy Kewney and associates report on an Asian PC manufacturer's deal with IBM to produce PS/2 clones; attempts by Lotus to keep users happy with another utility while they wait for 1-2-3 version 3.0; and how to create 3-D effects with vibrating mirrors.

FoxBASE on the run

Imagine the scene, as the software bailiffs hunt around underneath your bed, in an attempt to impound your treasured copy of FoxBASE . . .

In the latest bout of computer industry 'look and feel' litigation, Ashton-Tate has filed a copyright infringement suit against Fox Software and the Santa Cruz Operation (SCO), accusing both companies of copying the concept and appearance of dBASE II, dBASE III, dBASE III Plus and dBASE IV.

Documents filed by Ashton-Tate mention three separate counts (copyright infringement, contributory infringement and unfair competition), which it intends to pursue against Fox Software and SCO. While there is established legal precedent protecting a program's 'look and feel', there has never been any legal precedent for claiming proprietary right to a programming language or a program's sequence of events. Should Ashton-Tate be able to establish such a precedent, it could have far-reaching ramifications for the entire software industry.

The strongly-worded infringement allegations by Ashton-Tate demand not only payment of damages, but also impoundment and destruction of all copies of FoxBASE, along with associated SCO versions of the product.

In a rapid counter to Ashton-Tate's claims, Fox Software

officials claim that the dBASE language is in the public domain, and that Fox Software intends to "defend all issues and seek relief for Fox Software technology misappropriated by Ashton-Tate and incorporated in dBASE IV." The company went on to claim that Ashton-Tate's suit resulted from "concerns about the inferior performance, technological weakness, and instability of their products."

As for the often-neglected users, the idea that the future of dBASE may be decided in the courtroom rather than the development lab has annoyed the dBASE community. Most agree that in the Ashton-Tate/Fox Software lawsuit the ultimate losers will be dBASE users. The International dBASE Users Group (IDBUG) feels strongly enough about the suit to consider filing an amicus curiae (friend of the court) brief on behalf of Fox Software, according to an attorney specialising in computer law who is reviewing the Ashton-Tate case for IDBUG.

Meanwhile, this latest item of 'look and feel' litigation may well put a damper on Borland International's plans to develop its own dBASE compiler, codenamed 'Golda'. The forthcoming product, while highly compatible with dBASE, is rumoured to include a 'Borland-style' interface, similar to that of Turbo Pascal 5,

and reporting facilities that resemble those of Paradox.

Borland's cost trap

To the annoyance of Turbo Pascal fans Borland is asking half the price as it charged for version 4.0 for

an 'upgrade' to version 5.0.

This, I can state clearly, is not an accident or a one-off. It's an essential part of the company's new policy, which has already led to the dismissal of part of its R&D team, and more recently, to redundancies in its support staff.

In a nutshell, Borland has to sort out how it sells software or it dies. Either it sells cheap software by mail order or it sells costly business software through stores.

In the last year or so, there have been several Borland products that were neither one nor the other, and the company is hurting as a result. Ironically, most of the problems are not really Borland's fault. It has become caught up in a trap, baited with its own success.

The rules of selling mail order are simple but understood by few. Simply summarised — if you sell a product through mail order you have to charge a quarter to a fifth of the price it would carry in a shop. You have to spend a fortune on advertising, but this will be less than the cost of running a retail support and sales distribution operation.

The trouble was that Borland, which started off like this, got to be too well-known. People wanted programs like SideKick and Turbo Pascal, and they went into stores asking for them. Reluctantly, the storekeepers started stocking them.
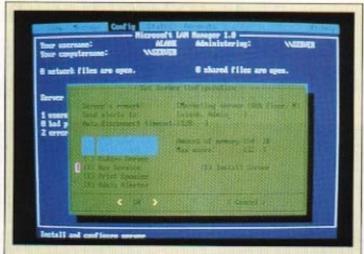
Then along came Quattro, the spreadsheet, and Paradox, the database; and even Sprint, the word processor, which will be ready one day. Borland announced that it would sell them cheaper than normal — half the price of the dBASE III, or Lotus 1-2-3, or WordStar package they were competing with — but twice or three times the price that people were used to from Borland.

The next noise to be heard was the sound of Borland falling between two stools.

Consider: a company wants 100 copies of Lotus 1-2-3. You go in as a software seller and say "buy 100 copies of Quattro instead."

The company doesn't say "Great! Half the price! We'll take 200!" — it buys 100 and saves the cash.

Unless you're a mug, you don't offer them Quattro un-

Following its official Australian release, early users of 3Com's 3+ Open LAN Manager are lauding the new OS/2 network operating system's full menu of features, while dismissing its alleged speed advantage. 3+ Open is the first of a forthcoming wave of LAN Manager-based software scheduled to hit the market.

Praised for its ease of installation, initial security offerings and strategic importance as the first software available based on Microsoft's LAN Manager, 3+ Open's alleged high speed went unnoticed by many users. Comparing 3+ Open's speed to that of 3+, its predecessor, other users reported minor, if any, improvements.

Some users, however, question whether 3+ Open is currently an affordable alternative, because of the cost of the 2.5 to 4Mbytes of server RAM that it typically requires. The 3+ operating system requires between 640k and 1Mbyte of RAM, according to 3Com. The company has developed a specialised version of 3+ Open to run on its 3S/400 dedicated file server. Priced at $6426, the software is available now.

less they really insist. Why cut your turnover in half?

But the mail order buyers weren't sending cheques for $432. It was cheaper than Lotus, maybe, but it wasn't mail order pricing.

I'm a little surprised, despite all this, to find out how many American observers are predicting that the company will struggle to stay afloat. Computer companies have to get into a lot more trouble than Borland has hit before they die.

The company has had trouble with lots of late products, but they are now coming out. And Quattro is a viable spreadsheet, Paradox a viable database, and also a serious contender in the OS/2 market, if and when people seriously start using OS/2 as their operating system on the bigger PCs.

Even Sprint, once it is heavily revised and debugged, remains, in essence, one of the most interesting word processors around. If Borland can survive the couple of years before it is really ready for the market, it will make money out of Sprint.

You should look to see Borland products split into two ranks — the low-cost utilities and programming tools which sell through the post, and the more orthodox programs sold through stores with a higher price tag. If it is one of the latter you are interested in, expect prices to rise.

I hope Borland spots the need to keep upgrades in the low-cost bracket. Nobody's going to queue for a product which will inflate in cost by 50 per cent at upgrade time.
Guy Kewney

Mouse non-control

The arrival of the Amiga version of the game Zarch under the new name of Virus has failed to give me control of the flying space ship.

This is not the only game to fail with mouse control over a flying group of pixels.

In roughly the same postal delivery, I got Elite for the Atari ST. In both programs — and in others, lots of others — it's quite obvious that nobody on the team understood how to read a mouse.

Elite is still, for my money, the best space-trading combination of arcade and adventure.

Flying the space ship in Elite is a skill, and to master it you really need an analogue joystick. I got pretty good at flying the Cobra when I had a Robocom Bit-Stick. At a pinch, I can manage with a binary joystick, but I can't take on dangerous enemies. I know I'll never win a space battle with the Atari ST and a mouse.

It's virtually impossible to move the spin control — the one that rotates the spacecraft — fully over. It keeps picking up spurious mouse messages and re-centring itself before it reaches the side, so you can't rotate fast.

It's equally impossible to move the control that climbs or dives — a gentle movement of the mouse produces no effect at all.

Of course, you can play Elite from the keyboard. I know people who do. I've also met streetsweepers, casino croupiers, lavatory attendants and software support staff. Someone has to do these things, but nobody has to play Elite with a keyboard control. Don't do it.

Mouse control of a game is possible. Starglider and Starglider 2 are highly sophisticated mouse-control games. The techniques exist and can be imitated, if not borrowed.

Virus needs a different sort

of mouse improvement — you should be able to adjust the rate of mouse increments.

On the Atari and Amiga, I find the slightest movement of the mouse flips the hover-jet over. For test pilots of the Mirage this may be realistic, but I'm not, and neither is 99 per cent of the population.

Incidentally, it's just coincidence that both these games come from Firebird. Firebird (in my humble opinion) should shake its ideas up in this area, but that software house is far from being the only culprit. A quick examination of many other arcade games will quickly show that the authors have barely tried to emulate an analog joystick with a mouse.

Why the reluctance? It's the cheapest and closest emulation of a smoothly variable control available. Controlling it is the sort of skill you'd think a programmer would take pride in learning. It makes a game infinitely more playable, and (you'd think) sellable. But almost nobody bothers.

Incidentally, if you ever do find someone playing Elite, don't assume that you can 'have a go' — you could destroy the work of hours.

I found myself in a part of space where hostile craft were plentiful. Time after time I launched into space only to meet more enemies than my under-equipped ship could handle. Only the 'save game' button allowed me to restart on the edge of the dangerous territory.

Finally, I managed it. By luck, (some skill, perhaps) I managed to fly into an un-policed solar system and reach a space station.

All that remains, when you reach a space station, is to land. Not everybody can do this, but I can. I could see the station, far in the distance. Another five minutes, flying, manoeuvring . . . at this point there was a knock at the door.

I pressed the 'pause' button and went to let a friend in. While I was making the coffee, he visited the toilet. I

came up the stairs with the cups to find him admiring the start-up screen of Elite.

"Difficult game," he told me. "I tried to fly it, but it's too hard. How do you restart?"

The coffee, I assured him, would wash out, and the scalding wasn't *that* serious . . .
Guy Kewney

Pouring oil on troubled waters

As the launch of Lotus 1-2-3 Release 3.0 stretches into next year (and possibly the next decade), it is starting to

compete with the Second Coming as one of the longest-awaited events in history.

To maintain the credibility and loyalty of its shrinking user base, Lotus has been forced to add various sweeteners to the current 1-2-3 package, in lieu of the new release.
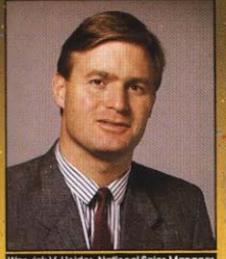
One of the most successful Lotus add-ins has been Sideways, from Funk Software. As its name suggests, Sideways lets users print wide spreadsheets sideways on normal-width paper with dot-matrix and laser printers.

To cap off what has been a relatively successful 1988, Australian modem manufacturer NetComm launched a pocket-sized 2400 baud modem known as the Pocket Rocket 1234, along with a version of its DataLock modem which supports the MNP error-correction protocol.

Barely the size of a pack of cigarettes, the Pocket Rocket supports 300, 1200, 1200/75 and 2400 baud transmissions, and is fully compatible with the Hayes command set, including auto-dial, auto-disconnect and auto-answer capabilities. NetComm had planned to launch the Pocket Rocket 1234 some time ago, following the success of its Pocket Modem 123, but was held up by the lack of volume supplies of the Silicon Systems K224 chip that it is based around. Apparently that chip is now available in more than sample quantities.

While Sendata had earlier this year announced a similar product, the NetComm unit will be the first to actually ship to Australian customers, according to officials. Sendata was one of the many Australian hi-tech companies which failed to make it through to the end of 1988 — a year which NetComm managing director Chris Howells described as 'tragic' for the Australian technology industry, during his speech at the Pocket Rocket 1234 launch.

Funk Software has now released Allways, a utility which spruces up one of the major shortcomings of 1-2-3 that Lotus is addressing in Release 3.0: its output. What's more, it's an add-in so formidable that even Lotus itself has endorsed it.

Both Lotus and Funk hope that Allways will keep 1-2-3 users in the Lotus fold until Release 3.0 (now slated for delivery in the second quarter of 1989) is available. To that end, Lotus Australia will bundle Allways (or a similar product) with Release 2.01, probably starting January. Details on the arrangement are still being worked out between Lotus and Funk's distributor, Imagineering.

Although 1-2-3 Release 2.01 (the current version) has a flexible PrintGraph module for graphs, its print-formatting capabilities for the worksheets themselves are rather restricted. This limitation has led some frustrated 1-2-3 users to explore other spreadsheets, particularly Microsoft's Excel, which sports some sophisticated print options — even though the Windows-based program needs to run on an 80386 machine to reach a reasonable working speed.

Allways accomplishes a host of spreadsheet embellishments previously unthinkable using a plain version of 1-2-3: these include multiple fonts, boldfaced text, underlined text, shading, colours, wrap-around boxes and integration of worksheets and graphics. Other formatting options include specification of margins, page size, headers and footers, gridlines and repeating borders.

In addition to accepting virtually any printer-supported typeface, Allways comes with a number of 'soft fonts' on two supplementary disks. Up to eight different fonts and as many as eight colours per file can be used. Running Allways requires a PC equipped with a graphics card; standards supported include CGA, EGA, VGA, Her-

cules or Compaq gas-plasma boards. It also works with virtually any printer compatible with Lotus 1-2-3.

OS/2 applications surfacing

With over 110,000 exhibitors trampling through its eight different venues, this year's Comdex/Fall exhibition in Las Vegas was undoubtedly the biggest ever.

As expected, OS/2 applications were plentiful, although most of these were character-based programs, with almost all Presentation Manager packages still at a pre-release 'look but don't touch' stage. Key major software developers, including both WordPerfect and Lotus, made significant commitments to OS/2 with announcements at the exhibition.

Lotus is shipping an OS/2 version of its personal information manager Agenda, which runs in the protected mode of OS/2 1.0 and can use the total 16Mbytes available to the operating system. The features are the same as the current DOS version but the OS/2 version can perform some functions in the 'background' and also runs faster with large databases, since swapping in and out of RAM is reduced.

WordPerfect formally announced that WordPerfect 5.0 for OS/2 1.0 would be available early next year. It will have a character interface similar to the current DOS version, while later in 1989 a version that exploits the features of Presentation Manager will be produced. The OS/2 versions will cost around 10 per cent more than the DOS version, and upgrade costs should be the difference between the two retail prices.

16Mbps Token-Ring

After months of rumours and speculation, IBM finally came clean at Comdex with news of its 16Mbit-per-second

Despite an ongoing lawsuit with Apple, Microsoft is still the leading supplier of Apple Macintosh software, and is continuing to release enhanced versions — after all, business is business.

The company used the MacWorld Expo in Sydney last month to debut a number of new products, including the first Mac version of QuickBASIC. The other new releases were Powerpoint 2.0, Word 4.0, Works 2.0, Excel 1.5 and File 2.0. All packages except Word are available now.

The new version of Microsoft's Word, due for release in January, has four components: Outlining View for outlining, Galley View for long document editing, the Page View WYSIWYG editing environment, and Print Preview for adjustments to page layout.

The new Mac version of the Excel spreadsheet (pictured above) has full support for MultiFinder and can be extensively customised. The $779 program supports colour for the Mac II, has 44 new functions and enhanced charting features. The $756 Powerpoint 2.0 has a templates feature to make preparing presentations easier. It now has a spelling checker, a search-and-replace function and it can import encapsulated PostScript files.

QuickBASIC 1.0 is a port of Microsoft's popular DOS Basic compiler. The QuickBASIC Toolbox Library is also bundled with the $196 program. Word 4.0 will cost $667, while Works is priced at $555 and File is $331.

Token-Ring network products. The new LAN technology supposedly puts IBM and its Token-Ring ahead of arch-rival Ethernet in the bandwidth stakes and introduces new enhancements to the IEEE 802.5 specification.

Shortly after IBM's announcement, more than a dozen third party companies, including Interlan, Synoptic Communications and NCR, pledged support for the 16Mbps Token-Ring standard with products due to arrive in 1989. Semiconductor manufacturer Texas Instruments has added its support with the announcement of a

special 16Mbps Token-Ring chip for compatible hardware products.

Available in stages over the course of 1989, the new IBM products include switchable 16Mbps and 4Mbps network adaptors for PCs and PS/2s; a new version of the Network PC Adapter II with increased onboard RAM; a new version of the PC LAN Support Program; two new versions of the Token-Ring Network Bridge Program and an Optical Fibre Converter.

The 16Mbps Token-Ring introduces a new 'early release' capability, which allows a workstation on the

ring to transmit multiple frames of data. A workstation can now transmit a new token without waiting for the return of a previously transmitted frame.

This technology is similar to that implemented within FDDI and means that two tokens may be in circulation on the network, explained IBM Australia's network product manager Keith Miller.

The new scheme constitutes an enhancement to the IEEE's 802.5 standard and IBM intends to press for its adoption by that body. The company was "confident" that the scheme would be approved by the standards committee, Miller said.

The faster LAN technology is aimed at users seeking a higher bandwidth than the current 4Mbps, particularly those with graphics and imaging applications. The 16Mbps bandwidth will also serve as a 'backbone' for users seeking to join several networks. While most current user needs are met by the existing 4Mbps technology, the growth in desktop publishing, image processing and other sophisticated applications made a higher bandwidth scheme increasingly desirable.

RISC for PS/2s

A 3000-guest reception for IBM PC dealers at Comdex was just one event in a massive campaign by IBM to promote its controversial Micro Channel architecture (MCA).

IBM recruited industry luminaries to press its cause, including Microsoft chairman Bill Gates, Intel vice president David House and Businessland CEO Enzo Torresi, who told the crowd that more than 50 per cent of Businessland's sales of 80286 and 80386 PCs were Micro Channel architecture units.

So much marketing muscle went into the MCA blitz that a long-awaited MCA product introduction — a Reduced In-

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struction Set Computer (RISC) coprocessor (pictured above) — nearly got lost in the shuffle.
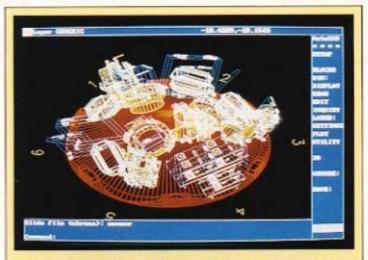
IBM's RISC coprocessor, initially introduced as one of the processors in IBM's 6152 Academic Workstation in the US, is now available on a request-only basis for all MCA-based systems. "Product introductions are less of a priority than educating dealers and users at this show," said Nick Donofrio, IBM vice president of marketing.

The RISC coprocessor, which takes advantage of MCA's highly touted 'busmaster' capabilities, was one of many processors demonstrated by high-level executives, including William Lowe, the ex-president of IBM's Entry Systems Division (now working for Xerox), and Chet Heath, the engineer credited as being the father of the Micro Channel.

IBM will announce its coprocessors within the next eight months, Lowe said. A high-resolution graphics card is scheduled for early 1989, and a Small Computer Systems Interface (SCSI) adaptor, to which users can attach up to seven peripherals, will be announced in the first half of 1989.

OOPS meets SQL in HP's distributed database system

Hewlett-Packard has been nursing an odd combo in its Palo Alto, California research dens that may prove to be just the ticket for graphics-intensive database chores like CAD, CASE and corporate publishing. Known as Iris, HP's prototype dataLase mixes object-oriented programming methods and Structured Query Language (SQL) with relational algebra to produce a distributed database system. This technology could enable database management systems not just to store information, but to spot flaws and in-

Autodesk has unveiled AutoCAD Release 10 — with the ability to create and edit all AutoCAD entities in any 3-D orientation.

The new version allows users to create precise architectural and engineering renderings with objects scaled according to perspective and positioned using precise reference co-ordinates. It can also automatically generate surface models of images derived from tabulated cylinders, ruled surfaces and Coones surfaces, features that are used to prepare aeroplane, maritime, architectural and civil engineering applications.

CAD specialists will enjoy user-defined co-ordinate systems, visual feedback for orientation purposes and 'Dynamic Viewing' commands which offer real-time, interactive display specifications. A new 3-D polyline and five new types of 3-D surfaces complete Release 10's list of drawing entities.

consistencies in the information as well.

The key to the real-world potential of Iris is its SQL module. SQL is already well-established as a database access language among corporate users. HP's object-oriented variant, OSQL, capitalises on the basic SQL syntax, substituting objects for field names in a query.

The HP approach could, for example, enable administrative personnel in an engineering work group to use familiar query tools to extract cost or productivity data from an object-oriented database. Since the objects contain not only data but also procedures for handling that data, such a database could easily handle a wide variety of data, including different types of graphics images.

In some CAD applications, OSQL can be used to help find flaws in designs. For example, according to Thomas

Ryan, HP's product manager for database technology, the system can be used to find bugs in circuit diagrams. "Imagine a circuit designer trying a command like this with a regular CAD system: 'Show me all the chips I haven't hooked wires to yet'. It can't be done."

HP demonstrated the technology at a recent object-oriented-programming convention and said it was basically testing the waters. If response is compelling enough, HP could kick Iris out of research and into marketing.

The company has no official schedule for commercialisation. But according to Ryan, Iris has been essentially complete for two years. It currently runs on HP's Unix systems. Iris technology could be delivered on just about any computing platform, said Ryan. "That would be marketing's decision."

Magnificent multi-tasking

Microsoft's Windows (386) does indeed look wonderful on a large screen like the Moniterm Viking range — and Moniterm has just started shipping Viking version 2, which uses the full 'publishing resolution' of its big monochrome display. If only the price were lower than $6300 . . . just imagine being able to run several concurrent programs, and see them all simultaneously. Sigh.

Moniterm Viking 2 is distributed in Australian by Megavision, tel: (02) 975 1877.
Guy Kewney

Atari's intentions

Just because people are writing about the 'Amiga-killer' version of the Atari ST due out any day now, doesn't mean you have to get excited about it. Concentrate, instead, on the news that a $5000 version of the Atari Transputer Workstation will be shipping around March next year.

The first few hundred are currently being sold with 40Mbyte disks, 4Mbytes of RAM, 1Mbyte of video RAM and a single T800 Transputer — to software developers. I was expecting to see full production prototypes at Comdex, but I'm blessed if I know how to benchmark them. And the Super ST? Don't hold your breath.

Watch for Stacey, the portable ST, which will definitely be out by Hannover Fair time (March), and quite possibly a few weeks earlier.
Guy Kewney

Doing it with mirrors

It's not a hologram, and you don't need specially polarised glasses to see it, but a three-dimensional image on the new Space-Graph Display System appears to float in a black void under the hood of the massive (330kg) unit. BBN

Introducing the new generation of XT compatible computers.

Laboratories in the US has developed this unique system that generates the images from any standard CAD files containing x,y and z coordinates, such as those produced by CADkey or AutoCAD.

The heart of the $US30,000 SpaceGraph Display System is a 16in circular mirror that's made of 3mm-thick acrylic. Thirty times a second, the mirror is alternately deformed between concave and convex. What you see is the reflection of the face of the x-y display (the monitor mounted above). Because of the optics of curved mirrors, the CRT appears to move about 80 times as far as the centre of the mirror actually moves, effectively creating a deep display from a tiny shift of the mirror. According to BBN scientist Lawrence Sher, it's effectively the same concept as the three-dimensional display your eye would see if you could oscillate a regular monitor back and forth 30 times a second. Because of the persistence of vision, your eyes 'see' a true three-dimensional image.

The actual size of the visible display is a cube about 25.5cm square, and the actual number of points that can be displayed in the visible area is 32,768. You can move your head about 30 degrees to either side of the mirror's centre line, and within these limits, you can look over, under and around the image.

BBN uses a unique method to oscillate the mirror: sound. The acrylic mirror is designed so that it resonates at exactly 30Hz, and a loudspeaker mounted in the back of the mirror provides the 30Hz tone. Sher said it's essential that an absolutely pure 30Hz tone be created, both to move the mirror and to avoid harmonics that might be audible. The tone is stored as a digitised waveform on a ROM in SpaceGraph's interface board, and it's converted to frequency by a D/A converter. According to Sher, this

is one of the major secrets for highly accurate control of the mirror's motion.

The display system's full-length interface board plugs into a 16-bit slot of any IBM PC/AT or compatible computer. Because SpaceGraph uses a nonraster analogue display, the board is packed with proprietary chips and four D/A converters. The unit comes with a command-driven program that performs some simple format conversion on CAD files.

Sher said the US Navy is using SpaceGraph to plot underwater weapon trajectories, and an aerospace firm is using it to graphically display finite element analysis. He said the price of Space-Graph will drop when it goes into volume production.

EISA plans announced

Advanced Logic Research, which makes some very fast IBM PC-compatibles, hopes to be the first company to

bring to market a system based on the new EISA (Extended Industry Standard Architecture) specification (see last month's Newsprint). ALR, which recently underwent a change of local distribution to Sydney-based Pericomp, is aiming for a release before June, 1989. Most other manufacturers have said that they will not have such a machine until the end of 1989.

The ALR system, company officials said, will use a 33MHz 80386 processor and have a 128k memory cache and a 128-bit bus, 64 more bits than the EISA specification calls for. It would presumably have 64-bit wide buses for both data and addresses, and would thus be faster than the proposed normal EISA bus.

Private viewing

A computer display which you could watch as you walk down the street might be almost insanely useful — but it

Like several other companies, Aldus chose last month's Comdex trade show in Las Vegas to demonstrate a pre-release OS/2 Presentation Manager application — the popular PageMaker 3.0 desktop publishing package.

The new version is remarkably similar to the current versions for Windows and the Macintosh. "PageMaker is the only application that will feature a compatible user interface and file structure across the three main platforms — OS/2, DOS, and Macintosh — which will greatly ease the transition to OS/2, particularly for corporations," said Paul Brainerd, the president of Aldus.

The new version uses the multi-tasking and multi-threading capabilities of OS/2, according to Aldus officials.

remains to be seen if anybody will actually go so far as to wear one in public.

Wear because that is how you have to use the Reflection Technology ultra-miniature display. It clips to your head, and you look into the tiny match-box size box through a magnifying glass.

The effect is cyborg. It is also a full display which no portable computer can rival — bright, clear and easy to read. And you can see it 'through' the world — one eye looking at the display, the other at the document, or even at the keyboard.

I don't know what the effects of looking at something for long periods with only one eye might be. I suspect you shouldn't do it.

However, Private Eye (a new invention by Reflection Technology) will cost $US100 or so in a year's time, and it will also get brighter.

That opens up interesting possibilities. Stereoscopic images, for example. Or how about sincerity-board displays? You watch a teleprompt reflection of the image which nobody else can see. And you can watch the rest of the world at the same time, with both eyes.

How is it done? It's a secret. Inventor Al Becker says that there are several patents he wants to get before he talks. However (intentionally or not, I can't say) he did drop a few hints.

What I think he has invented is a silicon chip with light-emitting red diodes embedded in an array on the surface.
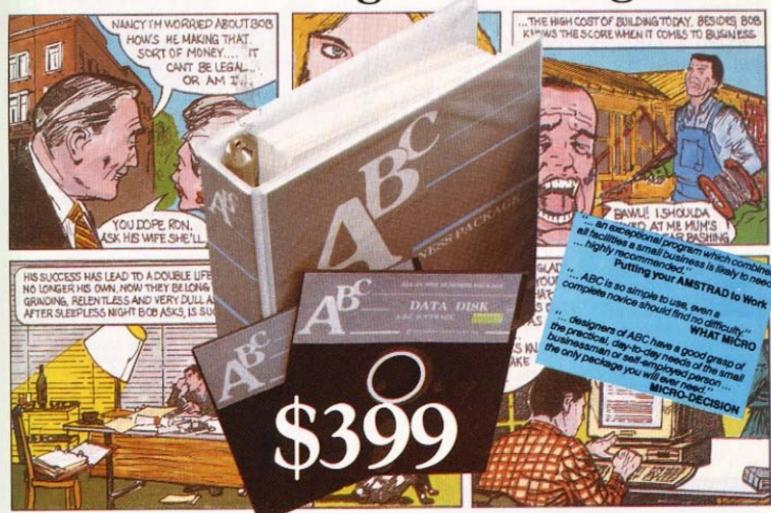
He says he is working towards a full colour version in three to five years' time — with red, blue and green pixels — but that the problem will be getting the blue bright enough. That fits with LED technology. He also said he won't be building the device himself because he doesn't have a silicon chip foundry.

I want one. It would be the end of trying to edit on tiny liquid crystal displays that don't show up in dim light.

Reflection Technology is at 171 Third Street, Cambridge, MA 02141; tel: (617) 547 4281.

Guy Kewney

Asian manufacturer jumps on MCA bandwagon

Traditional IBM-bashers who had all but dispatched IBM's Micro Channel architecture to an early grave are being forced to re-evaluate the situation, as the number of Micro Channel clone systems gradually increases.
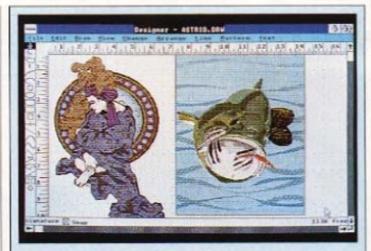
The biggest impact will probably come from Mitac International, one of Taiwan's largest computer manufacturers, which has signed a patent-licence agreement with IBM. The three-year cross-licence agreement, signed by Mitac in mid-October after eighteen months of negotiations, covers

patent rights on the XT, AT and Micro Channel architecture.

The contract, which still has to pass through government offices of the Republic of China, covers a hefty one per cent retrospective 'entrance fee' to be paid by Mitac for use of IBM patented products and technology, and future royalties ranging from one to five per cent that will be dependent on products and sales territories.

In Australia, Mitac products are distributed by Melbourne-based Keller Automation, which officially launched the MPS1000L Model 30 clone in June. The company expects the new Micro Channel-based systems to arrive in Australia early next year.

The Mitac Micro Channel systems were displayed at the recent Comdex/Fall exhibition in Las Vegas, along with new models from French manufacturer

Inspired by the industry's gradual move towards the OS/2 Presentation Manager, Windows seems to have finally taken off, with powerful applications appearing from companies other than Microsoft. Recent examples of these include Owl International's Guide 2 hypertext program and Samna's Ami word processor.

Possibly one of the most powerful PC graphics packages ever is Release 1.3 of the Micrografx Designer illustration tool (shown above), which now lets users tap into the extra memory provided by the Lotus/Intel/Microsoft Expanded-Memory Specification.

The new version is distributed in Australia by Info-Magic, and its support for EMS, which enables users to access memory beyond the 640k DOS limit, lets users create larger, more complex illustrations.

Designer 1.3 offers full-colour graphic art, technical illustration and drafting capabilities. Designer 1.3 runs on 80286-based or 80386-based PCs with 640k of memory, a hard disk and an EGA or VGA card.

Normerel Systemes. Many analysts claim that the Micro Channel architecture has caught on in a bigger way in Europe than it has in the US or Australia. Besides the Normerel Micro Channel PCs, European PC buyers can also choose from the Apricot Qi systems or the genuine PS/2s sold under the IBM or Ferranti labels. Furthermore, rumours continue that Amstrad and Olivetti both plan Micro Channel product announcements in 1989.

DR loyal to DOS

News of DR DOS reached me not from a press release but from an anxious reader who wanted to know whether it was compatible with MS-DOS. A supplier had told him they wouldn't supply him with MS-DOS 3.3, only DR DOS 3.35. Being of suspicious

mind, I decided to investigate.

It turns out that a number of cut-price machine manufacturers are selling DR DOS because of good pricing deals with Digital Research. The said supplier even managed to get GEM Version 3.0 in the package as well. But there was still a doubt in the back of my mind — was it fully compatible with DOS? Or was it just another release of CP/M-86 with fewer incompatibilities?

From my preliminary testing I found it to be completely compatible with DOS and it even provided enhancements to many of the utilities.

The added features fall into two categories: entirely new commands, and additional features to the old favourites. New commands include DelO and EraQ (delete files with query); Password (enables levels of protection

This advertisement is aimed at the sceptical professional.

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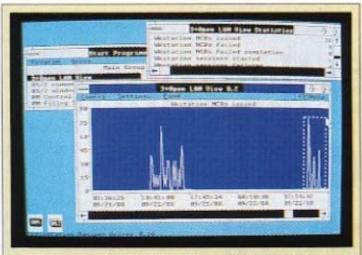Simple: You're paying too many "middlemen" margins!

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THIS IS DIRECT!

Dubbed the 'cable tamer', a new device from 3Com uses a process known as impedance matching to convert a signal that runs on standard Ethernet cable into one able to run on mainframe or ARCnet cable (also called RG-62). The new product will allow users to set up Ethernet PC networks using 3Com hardware and cable originally laid for either IBM mainframe terminals or ARCnet PC networks.

The idea of a cable tamer "is hot, because many companies [those with IBM mainframe terminal cabling and ARCnet networks] won't have to re-cable to install Ethernet LANs," according to networking consultant who has seen the product.

to be assigned to files); and Touch (allows time and date stamp to be reset).

The command enhancements just remove some of the idiosyncrasies from MS-DOS and make some commands actually usable (TREE, for example). Also, many of the error messages have been improved upon. For example, the RMDIR error message of 'Invalid path, not directory or directory not empty' is no longer given. Instead, three error messages occur, one for each situation.

As far as I can tell, this is a great improvement on the Microsoft version of DOS. It should also reassure DOS users who are worried that Microsoft may cease to support DOS as OS/2 gains popularity. If Microsoft abandons it, Digital Research won't.

Andy Redfern

END

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IPC AT / FE	Enhanced 102 Keyboard / MS-DOS 3.3 + GWBasic	With Paradise EGA and 14" Colour Monitor	$3050
IPC AT / 20M	AT Turbo Compact 80286-8/12 MHz/640k RAM/8 Expansion Slots 1 Floppy 1.2MB/20MB Hard Drive/Parallel — Serial Ports	With Hercules Type Card and 14" White Monitor	$2895
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IPC AT / 40E	Enhanced 102 Keyboard / MS-DOS 3.3 + GWBasic	With Paradise EGA and 14" Colour Monitor	$3895
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LETTERS

Smashing experience

Every time I see an article on portable/laptop computers these days, especially in airline magazines, I get upset.

I own a Compaq Portable III which I use extensively, and I have recently spent over $5000 in repairs (that's what it costs for a new plasma screen, a new hard disk, and a new rear case — no allowances for data loss and loss of opportunity to use).

Since August 1987, I have carted it all over south-east Asia in aeroplanes and all over the Northern Territory in my Toyota with no problems — until one day in August at Alice Springs airport when I was requested to check it in. Reason? It weighs more than the 4kg (yes that's right — the equivalent of two two litre bottles of milk) legally allowed on board an airplane in Australia as cabin baggage. The Compaq in its carry case fits inside the baggage regulation device at airports and fits under the seat of every commercial airplane I have flown on. But it does weigh about 10kg. The check-in clerk politely but firmly insisted that I check it even though I told him it was a valuable computer. "Don't worry sir," he said, "I'll put a Fragile tag on it."

When I retrieved it in Perth, it was smashed.

I began the process of trying to recover what I could from these well-mannered vandals, and have in the process learned quite a lot that I would like to share with you about the great idea (in principle) of being able to take your personal computer with you on an airplane for work away from home. Read this, fellow workaholic:

• Very few, if any computers, 'laptop' or 'portable', with acceptable performance characteristics weigh less than 4kg.

• If you make a claim on an airline in Australia for damage to checked baggage, they are limited by statute to a maximum of $900. My lawyer advises that it is not worth trying to recover the rest.

• If you try to insure your computer for the journey, you will find that the maximum limit of insurance for fragile items (such as $8000 computers) is $200.

• The only way to obtain adequate insurance through the airlines on airborne goods is to send them air freight with insurance (and God only knows when you would ever see it again when you're in transit).

• If you are not requested to check your computer by the check-in clerk, a flight attendant may request you to do so as you are boarding the plane. In this case, there is no guarantee that it will travel on the same flight.

• If your portable computer is covered by a policy with an insurance company, make sure the policy applies to the circumstances described above, including interstate and international travel.

I understand that the 4kg weight limit on cabin baggage is for safety reasons, but it seems to me that this limit is being arbitrarily applied to discriminate against computer carriers. From what I have observed, there are many briefcases on aeroplanes which weigh more than 4kg, and I would have little to complain about if the same rules were applied to these. I think there would be a low hazard if both were allowed at any reasonable weight provided they can be stowed away during takeoff and landing.

As my experience demonstrates, travelling with computers can be a smashing experience.
G Eupene

A spokesperson for Australian Airlines confirmed the hand-luggage limit is 4kg, and also said that checks were arbitrary. So, take your chance — if you dare! — Ed.

Plain-wrapper software

Why is it that 'perceived value' plays such an important role in the software market? I'm talking about the widespread tendency to think that if a package doesn't cost $600, it can't be any good. Look at what you get for your $600: four diskettes, a manual (hopefully readable) and a lot of fancy packaging. Alright, the Lotus Manuscript may look like a work of art before you take off the wrapper, but how good is the software? All too often it seems that an established name, a hefty price tag and a dose of attractive artwork means that the program just *has* to be superior.

I'm a keen user of shareware programs like Jim Button's PC-Write. It's an excellent program, well documented, full-featured, and you don't need to mortgage the house to get a copy.

I read recently that Brown Bag Software, who also do some fantastic low-cost packages, were hiking their prices to get a more positive reaction from corporates. How ridiculous! Now the average user will have to pay more for quality software like PC-Outline, and the AI-based word processor Mindreader — all because large companies are used to paying 'corporate' prices.
J London

Makes your mouth water

J J Clessa's Quickie section in Lazing Around enjoys considerable popularity where I work, and usually we don't have too much trouble solving the puzzles. However, the 'tasteless problem' in October's issue really threw us.

Thankfully, after several days of lost sleep and cerebral wrestling, we finally cracked it, and the tortured countenances of those around me began to return to normal (ie, only semi-tortured).

Despite the inter-office agonising it generated — which spanned two States — we really enjoyed the puzzle, and hope you will continue to publish such formidable brainteasers in the future.
S Muir

Reed-only memory

There's no denying the fact that the Mac has made it big in the music industry. A few months ago, I had the pleasure of seeing Sting in concert. He had a Mac SE on stage actually being used by none other than Branford Marsalis, and Branford handles a mouse nearly as well as he handles a saxophone.
N Haukap

END

FROM AMSTRAD, A PORTABLE PC AT A GIVE-AWAY PRICE. (WELL, IT IS NEARLY CHRISTMAS.)

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Christmas comes but once a year, so make the most of it with this "Christmas-only" offer from Amstrad.

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(For those who want a more powerful model, this same offer also applies to the 640K RAM PPC640; prices start at $1599 for the computer, monitor, PPC Organiser, Mirror Communications and the integrated software package, full specification in-built modem and the PC training course.)

So if you're looking for the perfect portable computer package, all your Christmases have just come at once.

You'll have to hurry to take advantage, though, the offer ends on December 24th.

Shop early for Christmas!

SAVE $700.

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For the price, you get the works.

Steve Jobs has launched his NeXT machine to its own stereo fanfare — our US correspondent Tim Bajarin reports on the computer industry's reaction and other new American developments.

Jobs' NeXT at centre stage

The Louise M Davies Symphony Hall in San Francisco is considered one of the best concert halls in the world. So it is no wonder that, three years after his departure from Apple, Steve Jobs should choose this place to unveil his new NeXT computer, a powerful graphics PC with full stereo sound capabilities.

As the curtain went up, it was Jobs and his machine at centre stage — he played it like a conductor and the computer was his musician. The auditorium was packed as thousands sat in excited anticipation, waiting to participate in another round of event marketing.

While at Apple, Steve Jobs was a master of this concept, as everyone who was anyone in the computer world waited to see what new machine Apple would bring out next. And returning to the limelight after three years seclusion working diligently on his new machine, Jobs has carried on this tradition of event marketing and made it one of the hottest tickets in town.

In fact, since the seating was limited to around 4000, tickets were being sold for as much as $US100 as people clamoured to be a part of this media event. A photographer who was part of the 'Day In The Life' series flew all night to get to this event, claiming that missing it would be like missing the invention of the light bulb. If he missed it, he would never forgive himself . . . and he wanted to be able to tell his grandchildren that he was there.

Against all the build-up and rumour, the event itself seemed almost anti-climactic. Over the last 18 months there has been a lot of hype and speculation about this machine, and much of it has been right. All the talk about a Motorola-based 68030, with great graphics and sound, along with a CD read/write system was true.

All the talk about an easy-to-use software development system was also true, making the software the most interesting part of the launch.

But, compared to the launch extravaganzas that Jobs participated in while at Apple, this one was rather tame. He spent the first 45 minutes explaining his concept of computing, and then he started to show off his computer. And it was just Steve and his machine.

He demonstrated the graphics and the development software, showed how the CD read/write will work, and explained the fact that he saw this as an education machine and that he planned to spend at least the next three years going after only this market.

The full specifications of Jobs' workstation can be found on page 38 of this issue, so I'll concentrate here on some of the industry's reactions, which were very mixed.

The most notable contrast came from Jonathan Seybold, the president of the Seybold publishing group, and his younger brother Andy Seybold, president of the Seybold Computer Reports. Jonathan has been close to Steve Jobs

Steve Jobs at the launch of his NeXT computer

and a real fan . . . and his praise for the machine ran high. But, Andy Seybold said: "I don't think the NeXT machine will amount to one per cent of the market. My whole take is that it is a marvellous use of technology with a price tag that will make it a non-seller."

Similar reactions were expressed by the vendors who attended. Hardware people said: "It's a great machine but we can do the same things in time."

Software folks loved the hardware, but said that they also could replicate the software authoring concept, and in quick time.

Fred Gibbons, president of Software Publishing, said "Remember, he who has the most software wins." And Bill Gates, president of

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APC3

Microsoft, challenged anyone to show him "where there was any innovation in the NeXT computing platform."

Gates appears to be particularly concerned that NeXT and IBM have got together to produce a windowing interface on AIX, IBM's version of Unix. Taking this type of control out of Microsoft's hands threatens its OS/2 Presentation Manager platform and could hinder the acceptance of OS/2.

The blending of technologies seems to be the most important part of Jobs' plan to regain his industry role, lost when he was ousted from Apple in 1985. While at that company, everything had to be invented there, but now that he has matured a bit, NeXT insiders say that Jobs has become more agreeable to using outside technology to meet his desired goals.

Although the machine is targetted at the education market, its price is considered very high for a university student machine. But, as a business workstation, its sub-US$10,000 price tag, including 400dpi laser printer, could change the workstation user's expectations of what such a computer should be like.

Since Jobs maintains that he will keep his machine in the educational market, both Apple and Sun could quickly make their own workstations become as powerful as the NeXT machine, and, using their already established distribution channels, keep Jobs from ever getting into the business market.

Jobs doesn't seem too concerned about this, though. He claims that he only needs to sell 10,000 units over the next two years to be highly profitable.

There is no question in anyone's mind that Jobs, once called the 'PT Barnum' of computers, is back!

Mouse evolution

Marq Technologies has given the ordinary PC mouse new capabilities by providing a single unit that is highly modular in nature. It starts out as a mouse, but you can then add an image scanner, an optical character reader, or both, by inserting an optics cartridge into the front end of the mouse.

The shared components and proprietary tracking system of the MarqMouse help reduce desk space requirements and give users the flexibility to add one or several tools to their personal computer.

The MarqMouse provides 600dpi resolution, ballistic control — a technique that optimises cursor control across the screen — and four ergonomically designed programmable mouse buttons.

Add the scanning feature and you can have 16 levels of grey at 300dpi scanning resolution, a paintbrush-style scanning system that lets users capture images of different sizes by hand using a scanning 'window'.

With the OCR upgrade comes sophisticated, topological recognition software with a very high accuracy. The transparent window lets the user see the data being scanned, and audio feedback — a sight-with-sound feature — gives users instant verification capabilities, enabling them to reach 100 per cent accuracy.

This audio feature is a very powerful addition to the OCR concept. With the audio feedback, a user hears numeric data through headphones or an earplug as that data is being scanned. Company officials say that in tests using this audio feature, users reported that they had tripled or quadrupled their productivity.

The MarqMouse costs $US199. The additional scanner, which includes the software and card costs $US799. The MarqReader OCR feature costs $US1299. Although this is a fairly costly system, it will spur many

STATESIDE

other vendors to copy this idea at a lower cost in the future.

DIY software

Alan Kay was one of the young engineers who sent waves through the Xerox Palo Alto Research Centre when he was barely in his twenties, contributing to the design of the mouse, windowing systems and various network technologies.

Among his more famous creations was the Dynabook concept of a powerful portable computer. He later took these ideas with him to Apple.

Back in 1971, Kay envisaged the day when we would have the power of a computer in a device the size of an 8.5in by 11in notebook. At that time the personal computer wasn't even a gleam in the eye of the Apple founders.

Now in his mid-forties and presently an Apple Fellow, which is a sort of Emeritus Professor at Apple, Kay recently spoke at the Seybold Desktop Publishing conference in Silicon Valley.

In this talk, he spoke of the day when we will get only the information we want through our computer instead of having to do extensive searches through whole databases. He calls this idea WYNIWYG or 'what you need is what you get'.

Kay maintains that the time will come when we leave our computers on 24 hours a day, and use software tools to flag only the material we want . . . and find it waiting for us when we sit down to work at the terminal. The most interesting part of the premise is the software.

Kay believes that the most important software market for computers in the 1990s will be what he calls user-programmable software — a way to develop your own screens and applications easily, and let them become your personal navigator through your data.

The core of Kay's idea is HyperCard or Hypertext, with

its data links, but he suggests that with this new concept users can actually build their own application programs, giving them control of all their information. This could take the form of a simple menuing system that links data, or it could be a program that eventually becomes a standalone application.

It is this very concept that has brought about the new NeXT machine. With his university ties, Steve Jobs has long felt that 'authorware' or 'courseware' was linked to the future of computer usage. By using Jobs' new machine and its authorware, a novice can create the applications that are fundamental to data manipulation. A more sophisticated user can delve deeper with the programming tools to create more powerful applications, and even generate the source code for the program.

Although Jobs may be a leading thinker in this area, his machine costs over $US6000 and is by no means the system that will make user-programmable software available to the mass of computer users.

What *is* within reach of a larger number of people is Apple's HyperCard and its scripting language, which will run on a $3000 Macintosh. Since its launch, large numbers of developers and ordinary Mac users have shown how powerful this user-programmable idea can be.

A good example is Danny Goodman, who is a computer journalist. He has had no programming training at all, yet he created two very powerful HyperCard applications called Business Class and City to City which are published by Mediagenic.

We do not expect that the general user may actually go after the commercial market with their products, but they could create innovative applications of benefit to the user community anyway.

HyperCard as we know it today is still too difficult to ap-

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peal to the broad user market. But Apple is working on making it more powerful yet easier to use. In the meantime, other contenders are arriving on the market.

A new company called Maxem has just announced Cause, a user-programmable Mac package that is object-oriented and so easy to use that it makes HyperCard's scripting language look archaic.

Maxem claims that users can be up and customising a screen and menu for their own use in less than a day. The company will also provide over 100 templates that you can buy to make the creation process even easier.

One of the more significant things they did was to develop a very similar product on the personal computer. The screens look identical to and work in the same way as a Mac's, and they can share the same files.

The Mac product costs $US495 and the PC product $US595, available now, from Maxem Corporation, 1550 East University Drive, Mesa, Arizona 85203, USA. Tel: (602) 827 8181.

One similar PC product is worth noting. Layout from Matrix Software is a powerful package that can be used on a standard 8088 PC with 256k memory.

With Layout, users can simply develop their own screens and menus, tie them to their existing database, or create their own database within the package. It includes its own paint and draw package so that you can add graphical features to your programs. And it creates source code in six major languages.

Although it is still considered more of a CASE tool, many of the people who have seen it say that Matrix Layout has the great potential to spread the idea of software engineering into the existing PC market.

Layout sells for $US149 and is from Matrix Software in Massachusetts, tel: (617) 567 0037.

Desktop mapping shows the way

One of the most interesting database graphics markets to start up in the US recently is something called 'mapping'. With this type of software you can link a business graphics program to maps of a particular city, and then point to any place on the map to receive data about that area.

For example, if you were in New York, you would load the New York City map into the system and could then

point to any place on the map and get an enlarged version of it. You could then point to a street, pull down a menu and ask if there were any hotels on that street.

Or you could ask the system to mark all the hotels in the city that have single room rates of less than, say $US150, and it will point them out to you. You could then see where they are marked on the actual street location, note the address, and instantly have an enlargement of that area.

This type of mapping information system has been available on mainframes and minis for years, but only recently has it come to the world of PCs.

The MapInfo Corporation has been a leader in this field, and just recently added a map code compiler to its mapping program to give users the ability to customise their maps in various ways.

Currently MapInfo works directly with dBASE III files, but it will also work with any database where the files are stored in ASCII format.

Where this type of product really makes sense is in the area of marketing and sales. With this program you can take your customers' database files and pinpoint them on the map, determining regional sales territories

as well as geographical data about the customers themselves.

In the field of delivery dispatching, you can find a street or location instantly — plus the best route to this location. Fire departments use it to find at a glance where they have their hydrants, and police departments are using it to overlay data from their databases to the street maps to see if crime patterns exist in a given neighbourhood.

Even the US Army uses MapInfo to track regional recruiting trends, to match with data held on their national files.

And international exporters use it to plot out their US marketing and sales programs. MapInfo contains maps for every major city in the US, and the company is working on maps of major Canadian cities.

An Australian user could buy the system and produce a map of Sydney using either the package's own limited CAD functions or by importing a map created in a program such as AutoCAD.

The base software costs $US750 and maps are between $US250 to $US500, available from MapInfo, 200 Broadway, Troy, NY 12180, USA; tel: (518) 274 8673.

END
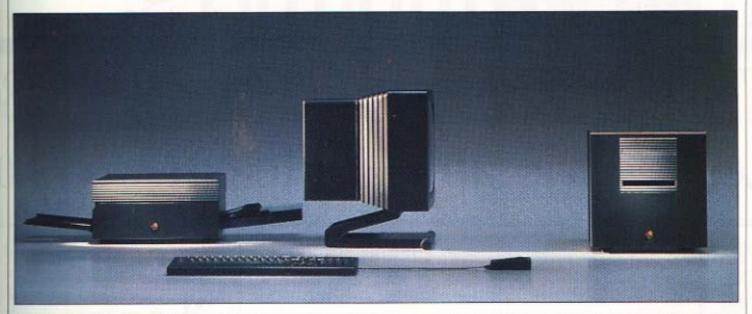
NeXT

The NeXT Computer System is very close to what designer Steve Jobs promised three years ago, and he is confident that it will be the micro for the next decade. Owen Linderholm says it's a breakthrough in price and power and may set an important standard.

When Steve Jobs left Apple three years ago and announced that he was going to build the NeXT thing in computers, he wasn't given much chance to succeed. But the NeXT Computer System is finally here. It has long been known to be intended as a Unix-based academic graphics workstation. However, it took so long to arrive that several other companies, notably Sun and Apollo, got well ahead in the field.

Out of the rumours, a few facts about the NeXT computer surfaced. It would use Display PostScript, a display version of the image control language Post-Script, for screen output; it would have especially good sound quality and control built in; the processor would be the Motorola 68030; and the operating system would be loosely based around the Mach version of Unix.

The real thing, much to everyone's surprise, has turned out to be very close to what Jobs promised all along. It includes a coprocessor and a digital signal besides the 68030, all clocked at 25MHz, giving it a processing speed of five mips.

The most dramatic of its features is the first erasable optical drive, storing a staggering 256Mbytes. The main circuit board is a masterpiece of design, is very densely packed and uses surface mount techniques wherever possible. Even more amazingly, every single component apart from one is implemented in CMOS, meaning that it operates more coolly and uses considerably less power.

The board is made by an automated assembly line and is untouched by human hand from start to finish. The assembly line is able to produce boards much more quickly and accurately than boards this complex have been

produced before; one of the reasons the final product is so cheap.

The system software is based on the Mach multi-processing version of Unix. Display PostScript is used to display a lightning-fast and very powerful graphical user interface with windows, menus, icons and object-orientated features.

It was designed in conjunction with an advisory board from US universities and colleges, and the collaboration shows in much of the design. The digital signal processor can be used for real-time data analysis, the 8Mbytes of RAM and 256Mbytes of disk storage provide ample space for research work and volumes of data. The operating system is based on Berkeley Unix, the academic standard, and a huge range of valuable research software is bundled with the computer.

Hardware

The computer is a matt, 30cm magnesium cube. It has stylish industrial design ventilation grilles on all sides. The only other features on the cube are two panels on the front for mass storage devices, one taken up by the optical drive with a wide slot showing; the NeXT logo at the bottom; the universal power supply connector at the back; and a cluster of ports along the bottom at the back.

There are seven ports at the back — two are 8-pin serial ports. There is also a standard coaxial connector for Ethernet, a 9-pin serial port for connecting to the NeXT Laser Printer, a SCSI (pronounced 'scuzzy') connector and a 15-pin D-connector to send and receive digital data from the digital signal processor chip.

The final connector is a 19-pin D-connector for the monitor, which carries the

monitor power, mouse, keyboard and sound signals. The monitor (only one is currently available) is black and hooks up to this with a 3m cable. It has a 17in display and shows 1120 by 832 pixels in four grey scales, giving it an on-screen resolution of 92dpi. It rests on an ergonomic stand, which is adjustable for height and can tilt and swivel. The stand's wheels allow it to be easily moved around on a desktop. The monitor also has a small speaker.

The keyboard connects to the base of the monitor and is also black, as is the mouse. Other connectors on the monitor include a stereo headphone jack, two stereo connectors for hookup to external audio equipment and a microphone jack.

The keyboard has 84 keys, including cursor keys, a numeric keypad, a power on-and-off key (the only on/off switch for the computer) and two keys to control volume and screen brightness. There are two Alt and two Command keys on either side of the main keyboard. The mouse plugs into the keyboard completing a long daisy chain. It is a two-button mouse, but the buttons are small and awkwardly placed.

NeXT's own laser printer is a 400dpi unit using a modified Canon SX engine. It is smaller than most current 300dpi laser printers and is designed to reduce paper jams. The printer also has a 300dpi mode, or 'draft' quality as Steve Jobs described it. It has a universal power supply and a paper feed mechanism that can automatically handle different sized paper and envelopes.

Naturally, the printer is also matt black. It runs PostScript and has no external controls — everything is controlled from the NeXT Computer. It doesn't need an expensive PostScript interpreter and controller inside it since the computer al-

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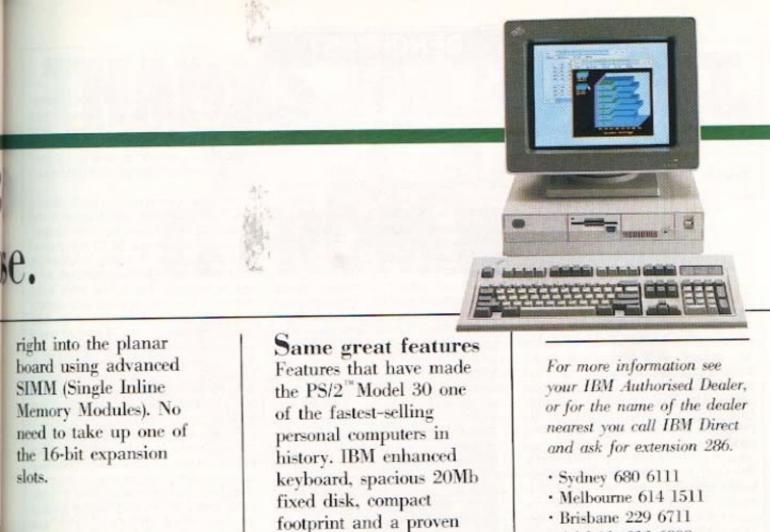
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ready has the more advanced Display PostScript. Instead, the computer does the imaging and the printer only has a single VLSI custom chip inside.

Inside the cube

NeXT uses a 32-bit version of the NuBus architecture made popular by Apple in the Mac II. The cube has four slots for NuBus cards, with one holding the main board. The board is extremely dense; it is 30cm² and holds *all* the circuitry to control the computer and its peripherals. The only non-CMOS component on this board is a single array used for video and Ethernet I/O.

In the centre of the main board are the two custom VLSI chips that NeXT designed for the computer. These are the largest chips on the board, and both are twice the size of the main processor. One chip, the Integrated Channel Processor, is responsible for much of the performance of the computer; a concept taken from the mainframe environment. The main bottleneck for microprocessor-based computers has been access to memory, and most microcomputer manufacturers have solved the problem by providing disk caches and processor caches to speed access between these

and the memory. Unfortunately, this isn't enough on a system designed for performance on a network. There are too many I/O demands on the system; it doesn't matter how fast the processor can run if it is constantly held up because of competing access for memory and processor time from the network, monitor, sound, printing, real time digital signal processing and disk access.
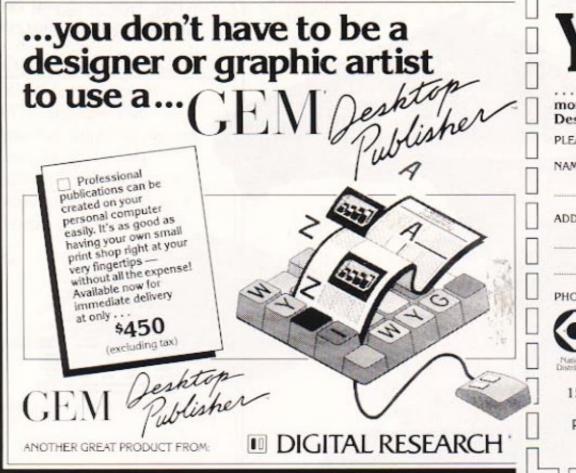
The measure of performance that NeXT is using bases 75 per cent of system performance on data throughput and 25 per cent on processor speed. NeXT concentrated on system throughput without compromising the basic processor speed and claims an average system throughput of 32Mbits per second, considerably better than comparably priced workstations or personal computers, and not much worse than a typical mainframe at 50Mbits per second.

The solution to throughput in the mainframe world has been to add a separate processor for every I/O channel to manage the flow of data between the device and memory. NeXT uses the ICP chip for this, which has 12 DMA channels that can be used to move data between an I/O device and memory without interrupting the main 68030 processor.

The ICP is optimised for these operations by including its own cache memory on-chip and by allowing it to make use of burst modes in transferring data to and from main memory, as well as by allotting a memory buffer to each DMA channel.

The other custom VLSI chip is allotted two DMA channels and it controls the 256Mbyte optical disk, the SCSI connector and the internal SCSI Winchester disk (if attached). This chip is known as the Optical Storage Processor and is required because the optical drive is so complex. The OSP includes error correction code circuitry that ensures the data on the optical disk is undamaged and it can correct read or write errors on the fly. It operates its DMA channels simultaneously — one is used for reading data off the drive or writing to it, and the other for transmitting data from the OSP to processor or memory.

In one corner of the main board is the system RAM — 8Mbytes in sixteen 100ns SIMMs of 500k each. RAM can be expanded on board to a maximum of 16Mbytes. The board also holds an additional port, a 50-pin SCSI for the optional internal hard drives. These are 330Mbyte and 660Mbyte full-size 5.25in drives made by Maxtor.

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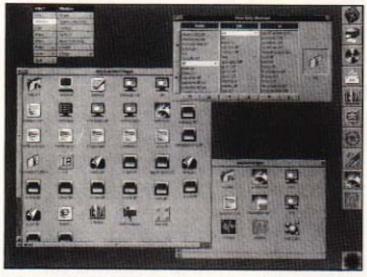
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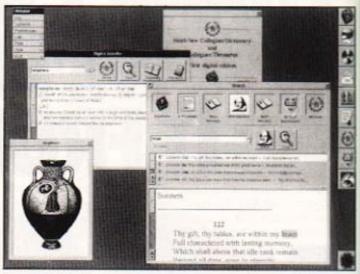
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The NeXT Workspace: menus always pop onto the top of windows; the file browser includes filename filters; and windows can be shunted off-screen

The Webster dictionary and thesaurus and the complete works of Shakespeare on the CD can be accessed by any application running on the workstation

Also on the board is the main processor, the 68030, clocked at 25MHz, and the 68882 numerical coprocessor clocked at the same speed. An additional coprocessor, the Motorola 56001 digital signal processor, is responsible for much of the good, real-world performance of NeXT. It was originally added to the system for the digital sound synthesis and recording, because this requires handling vast quantities of digitised information, but once it was added, NeXT discovered it could be allocated a large number of other tasks. The 56001 is a very advanced chip capable of processing its instructions at 10 mips, and is suited to performing array processing on large quantities of digital information. The DSP is being used for voice recognition software and is under development at Carnegie-Mellon University.

The DSP is useful for analysing other kinds of externally gathered digital information, an obviously desirable trait for an academic workstation, especially in scientific areas.

NeXT also has 32k of 45ns static RAM for use as cache and buffers — 8k is for the optical drive, allowing it to achieve a better performance, and the other 24k is used by the ICP for buffering. The video display has its own 256k of RAM, just enough to cope with the 232,960 bytes required by the display. Finally, a single 128k ROM holds the startup code for Unix — everything else is loaded off Ethernet or off the optical disk.

Erasable optical drive

This is probably the most important innovation in the NeXT computer. Despite

early rumours, it was not manufactured by Sony, but by Canon, which is not renowned for its mass storage technology.

The disks used by the drives look similar to standard compact discs in stereo systems. They have a 5in diameter and are contained in a plastic cartridge measuring 6in by 5.25in. The casing is otherwise similar to that of a standard 3.5in disk.

Although larger than a 3.5in disk, the optical disk cartridge is probably more robust, especially since it is less prone to damage from contact than a normal floppy disk. The disk surface has three layers — an aluminum surface, a substrate of a rare earth/transition-metal alloy, and a plastic coating for protection. The surface layers are translucent, so laser light can pass through and be reflected back from the aluminum.

The alloy layer is the key — it initially has a random crystalline structure and cannot be affected by a magnetic field when cool. To write information onto the disk, the laser is focused onto the alloy, heating it up to a point where it *is* affected by the magnetic field. If a magnetic field is applied, the crystals are aligned which gives the alloy layer different optical properties, so that a different amount of light passes through it. Two differing magnetic fields are used to produce two different alignments of the crystals and these correspond to the two binary states 0 and 1.

The disk works by first writing the whole area to be written to with the 0 orientation, which effectively erases it. Then a second pass writes 1s wherever required, and a read operation verifies the data.

To read information off the disk, the

laser is focused on the aluminum without the magnetic field, which prevents the alloy from melting or realigning incorrectly. Depending on what state the portion of the alloy is in, a different amount of light is reflected back and converted to a signal, to be interpreted as 0 or 1.

Since the optical head can be fixed above the disk and uses a precise laser beam, the optical drive is inherently more reliable than a Winchester drive and a head crash is impossible. And with the perfection of this technique, it should be possible to create an optical drive with better performance than a Winchester.

The drive has an access time of 96ms but, since data can be read more or less continuously using the OCP chip and buffering, the effective time can be improved. At the launch, Steve Jobs claimed the effective transfer rate was comparable to that of a medium-to-fast Winchester.

In NeXT's mind, the optical disks are to be the floppy drives of the system — no other mass storage device is available except the fixed Winchester drives.

System software

The software is even better than the hardware. The basis for the system software is the Mach operating system, a variety of Unix (and compatible with Unix 4.3 BSD) developed at the University of California, Berkeley. Mach adds fast interprocess communication to the standard multi-tasking capabilities of Unix, allows shared memory use and adds threads. This theoretically allows NeXT to support multiple processors by giving separate threads to each processor, but in practice nothing has yet been

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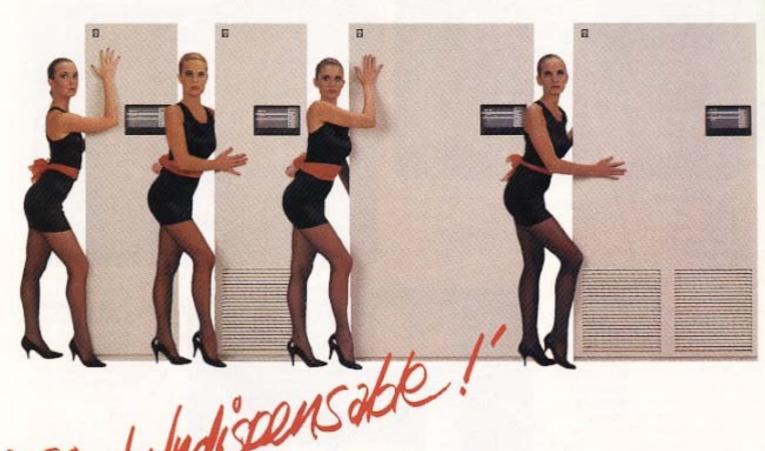
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done with threads. However, Mach does currently allow NeXT to support true multi-tasking with full interprocess communication, which means that multi-tasking applications can very easily share data and information.

The NeXT operating system also supports TCP/IP (the Transmission Control Protocol/Internet Protocol) for communication with remote systems, a standard on Unix systems. NeXT has licensed Sun's Network File System, and, since NeXT comes with Ethernet hardware built in, it is ready for use on a standard Unix network.

On top of the basic operating system there are several layers of system software, which NeXT calls NextStep. One part is Display PostScript, which Adobe developed in conjunction with NeXT and which has several extensions and improvements specifically tuned for graphics displays.

Display PostScript is held inside the Window Server, and this performs the same kinds of functions that X-Windows does on many other Unix systems. The Window Server handles all mouse actions, interactions between windows and menus, keyboard commands and so on. It deals with what it can, such as resizing windows and passing on keystrokes. Anything else is passed on to the appropriate application, which then informs the Window Server what to do.

On top of the Window Server are other interconnected layers — the most important of which is the Application Kit. This collection of 25 classes of object is used for building application interfaces. The user interface is object-oriented, allowing any text object, for example, to immediately inherit a whole class of properties related to text, such as fonts, sizes and text editing.

The interface objects provided by the Application Kit are available to any program at a higher level, including NeXT's version of the 'desktop', the Workspace Manager, and to application programs.

The next level up is intended for use by application programmers. It is essentially an application that programmers can use to build interfaces to their own applications. The program, Interface Builder, is in some ways reminiscent of HyperCard on the Macintosh, but it is much more flexible, giving windows, pop-up menus and other controls to any application program. These can then be hooked up graphically with other objects and actions provided by the application programmer, letting the user build an interface by visually sticking it together.

NeXT has supplied Interface Builder as part of the system software in order to

solve two big problems for programmers writing for the computer. The first problem is the inherent complexity of writing windowing interfaces for application programs, which can often take over half the programming time for an application and sometimes as much as 90 per cent. The second problem is the difficulty of porting existing applications between different systems. On Unix systems, the hard part has always been in converting the display and user interface portions of the program. NeXT estimates that Interface Builder can reduce the time to program the user interface to a negligible amount, at most 10 per cent of the time required for the application.

The Interface Builder generates code that can be integrated into a final application. All objects generated can be customised — it is even possible to continue extending Interface Builder, adding

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'NeXT is obviously a real breakthrough in price and power. It may even be the next big personal computer and NeXT thinks it will be the computer for the 1990s.'

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more objects, including application programming objects that might allow a programmer to build a complete application using only Interface Builder. This would allow a user to create a program simply by selecting a bunch of programming objects and linking them together — all done with the mouse, icons and windows! NeXT anticipates this will allow anyone with programming experience to create professional applications.

The user interface objects are very powerful. The basis of the interface is the icon — these are detailed enough to clearly show objects like a black hole (the NeXT equivalent of the trash can). Menus are fully hierarchical and pop-up, and they also stay popped-up until closed. Menus are all tear-off in that they can be separated from each other and moved anywhere on the screen; windows are fully movable and sizable and have scroll bars on the left and bottom, and there are boxes on the frame for closing and resizing. Like Microsoft Windows, windows can be collapsed to an icon while the application continues to run.

The final part of NextStep is the 'desktop', called the Workspace Manager. The basis for controlling the system here consists of two parts — in

A physics application being constructed. Many tools are available to the programmer. Here, the user interface is being designed

While molecular models spin in two windows, the Scope function is analysing speech captured through the machine's built-in microphone

general use, the most important is the icon dock, a fixed line-up of icons down the right-hand side of the screen corresponding to the main menu on other systems. If the full screen is required for any reason, the icons can be slid downward leaving the NeXT icon alone in the bottom right corner.

The browser is the other main part of the Workspace. This is a sophisticated directory manager program and, while directories are usually displayed as file icons in a window representing a directory, files can also be looked at using the browser. This is a window that can be opened and which has at least three subwindows — the first is an iconic or test list of all the files and directories currently available. If an item is selected, a subtree appears in the next window, and so on. It is also possible to select to make visible only certain types of file, and these can be chosen on type, creator, date, size and so on.

Electronic mail like you rarely see it. Each person on the mail directory can have an associated photograph. Notice the 'Black Hole' used as a trash can equivalent

Application software

The application software bundled with the NeXT Computer System is just as impressive as the system software and a big incentive to buy the computer.

The most important section is the Digital Library, which allows users to store and access online versions of any text reference works, libraries of digitised graphic images and collections of digitised sounds. Included in the Digital Library is the Digital Librarian, an indexing and searching tool to give users almost instantaneous access to any textual information. The speed of search over many megabytes of information is phenomenal. The Digital Librarian took one second to find five references to the word 'books' in the Oxford edition of Shakespeare's 'Complete Works'.

Users can add to the Digital Library any textual, graphical or sound information they create or to which they have access. To get the average NeXT user started, the following reference works are included free: Webster's 'Ninth New Collegiate Dictionary' (complete text, including definitions, pronunciation, etymology and illustrations), Webster's 'Collegiate Thesaurus', 'The Oxford Dictionary of Quotations', The OUP Edition of 'William Shakespeare: The Complete Works', all the NeXT technical and user documentation and other technical references. These are all accessible from within applications. For example, the bundled word processor, WriteNow, uses the dictionary as its spelling checker: a double click on a word in the word processor brings up its definition from the dictionary.

Two object-orientated sound tools, called SoundKit and MusicKit, are available for developers as part of the application software. Used with the DSP chip, these allow the programmer to write applications to record, modify and play back digitised sounds and music.

A full range of programming tools is included such as Objective-C 4.0 from Stepstone, an object-oriented version of C used to interact with the object-oriented user interface. There is also a full GNU ANSI C compiler, a GNU C debugger with extensions for Objective-C, GNU EMACS for program editing, the standard 4.3 BSD Unix utilities, a terminal emulator, a windowing text-editor and a set of DSP tools for array processing.

There is still a wide range of end-user applications to come in the list of software bundled with the NeXT Computer — there is an electronic mail program compatible with Unix mail, but with a graphical user interface and digitised sound for voice mail included; and Jot, a basic personal information manager for storing and retrieving notes, ideas, reminders, electronic mail, documents, papers and any other text information.
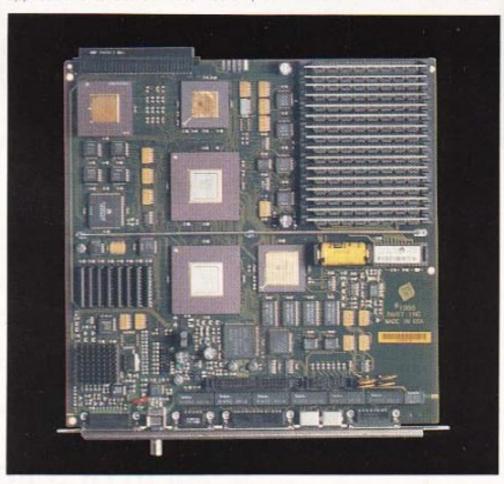
The word processor bundled with the computer is WriteNow, a graphics and text word processor with a great deal of power, re-designed specifically for NeXT. Mathematica, the analytical and calculation-based mathematical program, is also included free and is capable of solving complex calculus problems or differential equations as well as performing algebraic manipulations and final calculations. In addition, there are hooks into Mathematica enabling any external program to use it, so application developers can use its power in their own programs.

Also included are the Sybase SQL Database Server (so database applications can be easily created) and the AI language, Allegro CL Common Lisp.

Pricing

So what does it all cost? Even a conser-

The complex design of the NeXT system unit owes a lot to the design of the motherboard

vative estimate would put the value of the bundled software at close to $US3000; add in 8Mbytes of RAM (about $US4000), the advanced hardware (say, another $US3000) and you get a minimum price of $US10,000.

Incredibly, the complete NeXT Computer System will cost US universities only $US6500 with everything included, and the NeXT Laser Printer will cost only $US2000.

Only US pricing is available, as details of Australian distributorship have not been finalised. Megavision and the Lionel Singer Corporation are both currently negotiating for exclusive Australian rights to distribute the workstation.

Conclusion

NeXT is obviously a real breakthrough in price and power. It may even be the next big personal computer and NeXT thinks it will be the computer for the 1990s. Steve Jobs believes personal computers have life-cycles of about 10 years; the first of these was the Apple II line which is now almost finished; then came the IBM PC which, despite the clones, peaked technologically in 1986/87 and has another six years to go on a downward slope. Another 10-year cycle may occur with 80386 machines and OS/2, while the Apple Macintosh is due to peak technologically next year. NeXT believes it can take over the market as the Macintosh declines.

There are, however, serious doubts about NeXT, such as how compatible it is in the real world with other existing Unix systems; how easy it will be to port applications from other systems using different complex windowing systems, in particular, X-Windows; whether NeXT can really deliver the machines in quantity at that price; the limited nature of the academic workstation market; the lack of any floppy drive; the difficulty of backing up the optical disks; and how quickly the main memory will be eaten up by the memory-hungry system and applications.

NeXT can certainly sell every machine it makes in its first year to the US academic market, but what then? NeXT's investment in R&D and capital equipment, like its manufacturing plant, will take several years' sales to recover and maybe even longer at its current price. A year or so from now, I wouldn't be surprised to hear that the NeXT computer is going on sale worldwide to anyone with the money — but I bet the price goes up for non-academics.

Even at $US10,000, NeXT would be a killer. Until then, if you want one, enrol in a US university.

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PFS:First Graphics

Everybody's talking about desktop presentation graphics and the market is filling up with products. Derek Cohen finds PFS:First Graphics worth recommending for those with modest demands and limited experience.

The hot topic of late 1988 has been desktop presentation graphics — the ability to produce slides and charts on a personal computer rather than in an artist's studio. And as with any new computer application area, the market has been filling up with high and low-end products of good and poor usability.

When low-cost desktop publishing packages first arrived, everyone from professional typographers to barely literates started churning out layouts produced on a computer. Having been a typesetter in a former life, I viewed with alarm the way appalling page layouts were being presented (and even used as pages in mass circulation magazines) as the fruits of desktop publishing. Pretty soon people discovered that having the tools — a DTP package and a laser printer — didn't immediately turn you into a good designer.

These grievances have often been aired, and it was with some trepidation that I viewed the arrival of yet another layperson's tool — the low-cost presentation graphics package. PFS:First Graphics (First Graphics from now on) from Software Publishing is aimed squarely at the personal computer user who wants to create word charts, tables and graphs of a better quality than can be produced by hand or with instant lettering and a technical pen, and at less cost than employing a professional artist.

First Graphics costs $250 and is geared towards those who want to produce simple but effective presenta-tions when their deadline was yesterday. Within five minutes it is possible to have a professional-looking chart on the screen, and another five minutes will put a laser-printed hard copy in your hand. There are few packages which can boast such instant productivity.

In fact, both the wording on the packaging and the opening sections of the manual indicate that First Graphics will meet the needs of people who may have bought the package purely to do a single job and have no wish to learn anything more about presentation graphics.

The first chapter in the perfectly-bound 150-page manual is called 'Charts in a hurry' and is a step-by-step guide to producing your first chart. And it works. After that you can, if you wish, learn more about the extra refinements you can add to your chart. But, more impor-tantly, the manual's author has recog-nised that there are rules which, if fol-lowed, will mean that the user will produce better-looking presentations. So much of the documentation is not about how the package works, which is pretty simple anyway, but concerned with teaching the user how to design *good* charts and graphs.

Installation

First Graphics is supplied on two 5.25in floppy disks and one 3.5in disk. Little special installation is required beyond copying the files into a suitable directory on a hard disk or onto backup floppy disks. There are 45 files in all, but most of these are sample charts and presen-tations (a series of related slides).

Once the program has been loaded, it is possible to select your printer and plotter types, including which ports they are connected to, whether your charts are to be printed with a border and, if so, what type, whether you have a colour monitor, and which typeface you wish to use. The typeface names are barely meaningful and, as we shall see later, only one of them is really usable.

The elements of this Setup menu struck me as rather strange. Some parts of it, such as the printer, plotter and monitor types, are likely to be set only once. Yet typeface and border style might be changed with every slide produced, and ideally would be amended within the chart customisation pages.

I ran the program on an AT connected to a Qume CrystalPrint II, and a Zenith 386 driving a HP LaserJet II, both with hard disks and VGA displays, but it will run on EGA, CGA and mono (even text-only) machines and floppy disks. It needs 320k of RAM.
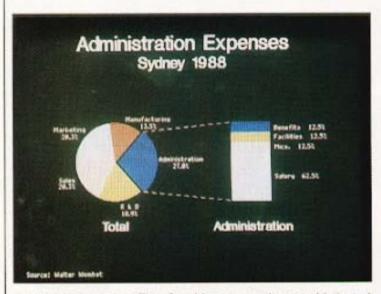
Printers supported include PostScript and HP laser printers, nine and 24-pin dot-matrix, the HP DeskJet, and a range of colour printers and plotters.

Creating a chart

First Graphics uses one main menu to access all the program's functions.

Despite its low price, First Graphics can produce sophisticated charts such as this linked pie and column. Colours can be altered, though the defaults usually work well

The setup screen for the chart alongside. The type sizes shown top-left bear no relation to real-world conventions. It is possible to specify an unworkable combination

These are numbered one to nine, with E for exit. No initial letter shortcuts are provided and I had to train myself not to press 'P' when I wanted to print a chart. While the main menus are coloured quite distinctly, the customisation pages use a barely readable light blue text on a dark blue background.

Throughout the package, reminders appear at the bottom of the screen as to which function keys can be used to perform various tasks, like displaying a chart or changing text attributes. I was disappointed not to find a keyboard template with the package as there were often functions available that were not shown on-screen. For example, F5 alters the attributes for a character, and this is shown on-screen; but Shift-F5 highlights whole areas of text, but is not shown, nor is Ctrl-Del to delete a line of data.

First Graphics produces six types of charts: bullet lists, free-form text charts, pie charts, bar or line charts, area graphs and high/low/close charts. In addition, pie charts can be linked so that a single 'slice' of a pie chart can be further analysed into another pie or column chart. For some of these types, 3-D versions are available and most charts can be horizontal or vertical in orientation.

The first step in creating a chart is to decide on its type and orientation. The program then presents you with a suitable table for entering the data. I'll work through a couple of examples to give you a 'feel' for how the product works.

I have a set of sales figures for different types of fridges which I want to show as a pie chart. I also want to fur-

ther analyse the sales of two-door fridges by whether they have small, medium or large freezer compartments.

I select a horizontal pie chart and fill in the table. Each slice of the pie can have a label and I can enter the value for that slice in absolute numbers. When it draws the chart, First Graphics automatically calculates the percentages for me, which I think is a nice touch. I also indicate whether I want any of the slices to be cut or pulled out. First Graphics will automatically allocate colours and patterns to each slice but the table allows

> 'Gothic and Script, look gimmicky, and the Roman and Sans Serif are very spindly and unbelievably badly formed.'

me to change both of them. In addition, I can give the table a title, sub-title and footnote. Each line of text can be given its own text size and location — left, right or centre.

Colours and fill patterns in First Graphics are specified by number — there are 16 colours and 12 fill patterns. But as these have to be specified by number, the only ways to know which number to key in are by looking them up in the manual or by choosing the numbers in turn and displaying the chart until you get the one you like. On a colour monitor there seems no reason for not displaying a colour table, or at least displaying each number in its own colour.

It was while enhancing the text that I came across another one of First Graphics' idiosyncrasies. It is possible to specify a text size as being anywhere between one and 100. One and 100 what? you may ask. As far as I can tell, six on the First Graphics scale represents about 30pt in conventional typography. At first I was confused by this and wondered why the default values for my chart were to have the text in 6pt. This package is likely to be a user's first introduction to presentation graphics and I would have preferred him or her to be taught how to use some real-world values like points or millimetres.

Having entered the data for the first graph, a quick press of F2 will display it on-screen. Another way to display the chart on-screen is to go to the Print menu and then choose to print on-screen. The difference is not immediately obvious, for even when, through the print menu, I specified that I wanted the chart to occupy only a quarter of a page and not to be printed in colour, what appeared on-screen was full-size and coloured. The only difference is that, if I selected a border style, this appeared on the print menu version of the display and not on the editing display. Thankfully, in practice this isn't as confusing as it sounds.

Pressing PgDn from the first data table takes you to another where the data for the second linked chart is entered. When the basic data has been entered, pressing F8 takes you to the Options pages where the chart can be further customised. The slices of the pie can show either the real value or the percentage for each category. In this section, too, it is possible to specify that the slices

should be ordered around the pie not in the order entered, but sorted by value. And on this screen there are also options for linking the pies.

The second chart can be another pie chart, or it can be a column chart, which gives a clearer contrast with the main pie. Dashed lines show which slice of the pie chart is being analysed and this quite sophisticated effect is achievable with little effort.

Other chart types

Having created one type of chart, it is quite easy to use the same data to create another one. Both charts and data are stored in memory. In fact, unless you actively clear the data area, you can keep modifying and saving the data and charts under new names. When you save a chart, the program attaches a description to it which has as its default the title of the chart. This helps when you want to load a chart to modify it, or when you want to create a presentation of a group of slides, because these titles are displayed alongside the file names.

For many people, a graphics package will be useful as an alternative to a word processor for producing word charts — basically lines of text with a heading. First Graphics provides two alternatives — free-form charts and bullet lists. Free-form charts are just plain textual frames with headings and lines of text in various colours and sizes. The text can be imported from external ASCII files.

Bullet lists are special, structured text screens or slides where each point is prefaced by a bullet or other symbol. First Graphics provides for only three types of bullets — a round bullet, a dash and a tick — and all the items in one bullet list chart must be prefaced by the same symbol.

Though the choice of symbols is limited, the manual does stress that the use of colour can enhance the logic of a bullet list. This was one of the places where I valued the tutorial aspects of the manual. It introduces the idea of a 'build up' presentation, where a bullet list is created line by line, with each 'slide' showing one more line. The manual suggests that each new line is shown in a different colour when it first appears, but that it reverts to the default colour on the following slides.

Data handling

First Graphics' data handling is quite smart. It is possible to get the program to create a set of x-axis values automatically by specifying the type, start and

increment values. So, for example, I created a high/low chart for share prices over a two-week period. I specified the x-axis values as being of the month/day type with a starting date of June 12 and ending on June 23. The program filled the table with the intervening dates. Once created it is possible to edit these values, for example to remove Saturdays and Sundays. First Graphics recognises different formats for dates and uses the way you have entered them as a guide to how to display them. So, for example, entering 'Mon' and 'Fri' will result in a table of truncated days of the week, whereas entering 'Monday' and 'Friday' will produce the complete words.

Calendar ranges recognised include days, weeks, months, quarters and years as well as times, so that it is possible to create a data table of, say, hourly temperature readings without having to type in all the individual times. Again, First Graphics uses the way you enter the limiting values as a guide to how it fills the table and displays the units.

Dates of the form 4/1/88 are recognised, and it uses the national configuration file to decide if this is an April or January date. Entering time values as 01.00 to 23.00 produces a 24-hour clock table while 1am to 11pm produces the alternative set of times.

It is also possible to ask First Graphics to sort the data for you, presenting a chart in ascending order or chronologically or by whatever order you entered the data into the table. And if you enter two values for, say, January, because different sales people are providing you with contributory figures, you can ask the program to do the accumulation for you and produce a summary chart.

Data can be imported from Lotus-compatible spreadsheets creating WKS, WK1 and WRK or WR1 file types. First Graphics uses both cell labels and data from spreadsheets so that, for example, bar charts can be labelled with the titles used in the spreadsheet. By using the append facility it is possible to build a chart from non-contiguous areas of a spreadsheet.

Customisation

For many of the charts there are a number of screens which allow limited customisation of the chart's appearance. The legend can be placed above, below or to either side of the chart, or omitted. Line styles, colours and fill patterns can also be specified, although it is not possible to specify these for individual elements of the chart, only as global values.

The 'Set X axis' option allows for automatic generation of values in the data table. Here, the months of the year were produced by specifying months starting at January and ending December. The light on dark blue colour scheme is hard to read

All charts must have a black background.

Strangely, if you specify that axis values should be extended as lines across the chart, First Graphics draws them in front rather than behind bars, which can reduce their effectiveness. It is sometimes better to dispense with them completely.

The customisation pages show all possible options for a chart, even when they are not valid. So, for example, it is possible to specify that a linked pie chart be 3-D when in fact only 2-D pie charts can be linked.

Similarly, not all typefaces are available in all typestyles. Only one, Executive, is available in outline form, but the 'Fill' option is shown for all typefaces. And while the function key reminders at the foot of the screen serve some purpose, they do not change as you move down the page so that, for example, the text attribute key, F5, is still shown when the cursor is in fields whose text attributes cannot be changed.

When a chart is created, the program chooses default values for text sizes and placement, axis values and so on. But through the options pages, maximum, minimum and increment values can be set for value axes, and the sizes and positioning of text altered.

Of the five typefaces supplied — Executive, Roman, Sans Serif, Script and Gothic — I found only the Executive (a

Helvetica clone) to be at all acceptable. Others, like Gothic and Script, look gimmicky, and the Roman and Sans Serif are very spindly and unbelievably badly formed. In fact, they look like the output from a very bad cheap plotter, even on screen.

Conclusion

I must say I am very impressed with this package. The graphs it produces look good and it isn't necessary to have much experience to produce professional-looking word charts and graphs. The documentation is excellent, both in its explanation of how to use the package and in the way it teaches good design principles.

The program's only real drawback is its typography, where I found only one of the typefaces at all acceptable. And, in this sense, the fact that the typeface can be selected once and for all through the setup menu is an advantage.

Other than that, I can highly recommend First Graphics for anyone starting out producing charts, whose demands are modest and whose experience is limited.

END

PFS:First Graphics costs $250 and is available from Imagineering, tel: (02) 697 8666.

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500 issues hence

Predicting technological trends is one sure fire way to end up eating your words, but long-term APC contributor, Ian Davies, nevertheless takes a hyperopic glance towards the distant future.

Albert Einstein once wrote, 'I never look towards the future. It comes soon enough'. In no field of endeavour is this more true than in the realm of computer technology — no matter how conservative one's requirements are, the future disrupts one's plans by its unchecked, headlong rush into the past.
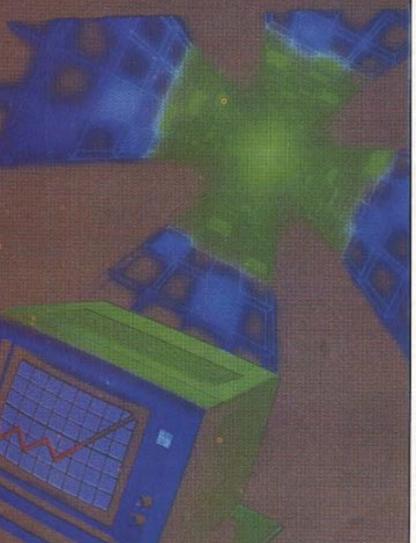
The industry abounds with instances of lack of foresight. Indeed, most machines currently in use are examples of such myopia. Most familiar to our readers would be the IBM PC architecture. When introduced in 1981, the PC came equipped with 16k of RAM. At the time, leaving a gap of 624k until colliding with the memory-mapped devices must have seemed like an abundance of expansion potential. However, within a matter of years, 640k has come to be considered a 'workable minimum' configuration.

The Prestel terminal standard, such as is used by Telecom's Viatel, is another example. The original standard design was based on the assumption that emulators would be implemented without intelligence, and that 1k was an economic maximum memory size. But perhaps the best

specimen comes from Tom Watson, past president of IBM, who estimated that the total world-wide market for computers would be . . . six.

These examples of shortsightedness are by no means an indictment of the people responsible. Each and every technology-based decision which looks ludicrous today was once taken based on solid technological fact. It has been technology itself that has caused the original 'givens' to be invalidated so embarrassingly.

More sobering is the thought that every one of us engaged in the computer industry today is making well-founded decisions which will go the same way as the ones above, and quickly enough that we will still be around to wonder how we ever could have been so shortsighted. Perhaps the epitaph for the computer industry should read 'well, it seemed like a good idea at the time'.

From the above, it appears that any attempt at medium or long-term projection is destined to fail. History shows that all of our best attempts to plan for the future were distressingly off the mark.

It follows, therefore, that the best predictions can be made by carefully examining present day trends, and then discarding any extrapolation from them as patently incorrect.

Expected advancement

What does everybody in the computer industry currently want from the future?

Better graphics, more memory, faster processing, associative memory for fast sorting and volume-independent searching, voice recognition, video interpretation, self-programming and artificial intelligence would probably cover most desires. Others would be happy if the industry simply settled on one RS-232 connector standard.

It seems obvious that these desires will largely be met. If one works on the assumption that every 10 years, the power provided by mainframes migrates down to PC levels and mainframes acquire even more power, then the 200th issue of *APC* will see 100-mip PCs with 100-Mbytes of memory. Today's mainframe bigots will be 10 years older and explaining why PCs are *still* toys since they don't have the 1000 mips provided by mainframes of the day.

If that sounds unlikely, then just compare a 16MHz 80386 and 16Mbytes of RAM with the average mainframe used in the mid 1970s. (The difference, by the way, still lies in the I/O channel architecture.)

Ten years on is easy. One hundred mips, 100Mbytes, more parallelism, real-time TV quality graphics, a degree of voice recognition, and advanced software that degrades system performance to around the level of an 8088 application tightly coded in assembler.

What about the MCA, AT bus and EISA?

Who cares? These are the concerns of today, but amount to no more than a footnote at the bottom of the page of computer history. Contentious issues such as OS/2 fall into the same category.

Of course, we won't still be running MS-DOS constrained in a 640k contiguous address space. But then, we probably won't be running OS/2 or the MCA either. Support technology, which is essentially what these two standards are, have to be discarded and replaced as the mainstream technology advances.

Certain concepts embodied in OS/2 and MCA will be retained, such as multiple bus masters, and an operating system with an integrated user interface and DBMS. Again, footnotes in history. Who can remember which product first incorporated a shared data and program address space? Remember all the fuss about the idea of two programs running in the same CPU at the same time? Exactly.

Yes, 10 years is easy. Faster machines, better graphics, more parallelism. The figures above may be off by an order of magnitude in either direction, but in essence it boils down to 'more of the same', and predictions become easy.

Based on the principle that obvious extrapolations should be dismissed out of hand, perhaps we need to look further afield for the shape of the distant future.
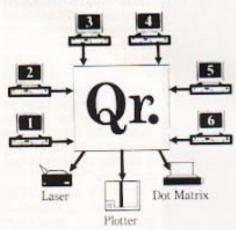
How far can it go

In the last 40 years, it can be estimated that computing hardware has improved by a factor of several billion. Just compare today's average PC with the old ENIAC vacuum tube computer commissioned at the University of Pennsylvania in 1946. In very rough (and conservative) figures, the PC is 1000 times faster, has 1000 times more memory, is 1000 times smaller, 1000 times cheaper, 1000 times more reliable, consumes 1000 times less power and is 10,000,000 times more plentiful.

Despite the fact that hardware advancement has slowed in the last few years and designers are starting to contend with physical limits on their ingenuity, such as

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the speed of light and the size of atoms, these trends will probably continue — albeit with some parallelism and the introduction of organic molecular logic elements already at the research stage. (To install your 256Gbyte upgrade, simply empty the sachet of enzymes into 100ml of water and incubate for 30 mins.) The idea of cloning hardware may take on an entirely new significance.

Software, on the other hand, has not progressed nearly so well, and would seem to be the greatest limiting factor on radical advancement in the industry. Writing an application that would take a year, where the only development tools are the front panel toggle switches, might take only a single day using a fourth-generation language — an improvement factor of several hundred.

Had hardware only improved as much, the PC on your desk would feature 1k of RAM, run like an 8088 at 0.005MHz and cost the best part of a megabuck. Needless to say, they wouldn't be called 'Personal Computers'.

The effects of the software lag are already being felt — simply look at the major news items of 1988. Delays in the introduction of MCA clones were all legal and marketing problems, not technical. On the other hand, 1-2-3 version 3, dBASE IV and OS/2 1.1 EE have all been delayed due to technical problems. (OK, OS/2 EE hasn't been delayed — IBM just estimate better.)

This is not news. The original 5000-man-year OS/360 project undertaken by IBM in the 1960s adequately highlighted the problems of large scale software development. The number of development projects at this level of effort is increasing as users expect more from their software products, and hardware capabilities allow such complex software to run at reasonable speed. In 1988, 500 programmer projects have not been unusual. One hundred issues hence, that will have increased by a factor of 10, with software productivity only two or three times better.

Clearly the trend cannot continue, as the gap between project size and programming productivity is widening.

Hell bent on destruction

It is partially because of this widening gap that the software industry is devoting so much of its effort to productivity tools, fourth-generation languages, fifth-generation logic languages, end-user computing, and programmerless application facilities such as HyperCard.

Yet all of these efforts have reaped only a few orders of magnitude in return, and have done little to address the large-

scale developments which tend to over-run and create an environment conducive to the breeding of bugs. Even the so-called 'programmerless' facilities such as HyperCard incorporate such severe flexibility limitations that they only address trivial problems.

A similar situation arose around the turn of the century with the introduction of the telephone. Telephones were rapidly becoming accepted in America, and with their growing numbers, the shortage of switchboard operators became the factor limiting growth. Someone estimated that if telephone installations continued growing at the same rate, within decades a large percentage of the US population would have to be employed as operators.

Similar predictions have been made about computer programmers, and are based on equally solid technological fact and trend projections.

In the case of the telephone, somebody invented the automatic telephone exchange, the problem went away, and anybody gearing up to cash in on the great telephone operator shortage went rapidly broke. Except exchange manufacturers, of course.

Can the same thing happen in the computer industry?

Quite simply, it must. MS-DOS probably took about 10 man-years to write. OS/2 EE, complete with PM and DBMS, has probably taken at least 1000 man-years. Its next generation successor can only be a larger job — certainly not smaller. Think of the software problems that have been pursued for the last 20 years and have *still* not been satisfactorily resolved: speech recognition, optical character scanning, natural language processing, intelligence and programmerless databases.

When it happens, not if, the worldwide demand for millions of programmers will vanish. Contractors, placement agencies and DBAs earning $50k plus car will also vanish. The high-flying computer professionals will go the same way as the geologist, inorganic chemist and coal miner — they exist, but so does unemployment.

The second time around

The software dinosaur will no doubt continue to be around in a further 100 issues of *APC*, but after 500, the issue must be resolved lest we all be waiting 10 years for the late releases of dBASE XI and 1-2-3 9.0.

We have said before that the computer industry is among the most innovative and vibrant, rivaled only by bio-engineering. Yet for this pacey business in which standards are obsolete as quickly as they are adopted, and state-of-the-art is relegated to historical interest within years, isn't it amazing that the whole show is based on a single, unchanged architecture?

The architecture is, of course, Von Neumann. Babbage originally devised the stored-program computer, but it was John Von Neumann who fleshed out the theory and originated the idea of a single, linear main storage. Virtually every piece of computing carried out today is performed using those same principles — a CPU and a linear memory. Certain embellishments, such as pipelined instruction caches, multiple processors and array processors are really just incremental variations on the same theme.

John Von Neumann's architecture has served us very well. It has taken us from calculating artillery projectile tables on ENIAC to simulating the creation of the universe on Cray X-MPs. But who is to say that there is only one architecture through which automated information processing can be achieved?

To establish a new architecture, just

one concept has to be discarded — the central processor. And we're not talking MCA here. Multiple CPUs are still CPUs. Eliminating the CPU, by definition, eliminates linear memory, and hence any bus or channel structure. The idea of a stored program implemented as a series of steps is also, of necessity, discarded. Moreover, by removing the CPU, the major bottleneck in performance is eliminated.

Can information processing be achieved through such an unconventional architecture?

Indubitably. The answer is self-evident, for this is how organic information processors such as mice and men operate.

Now, before being shot down by arguments of souls, deities, disproven evolution and the obvious differences between humans and animals, it should be pointed out that research progresses in this area, and the results are already indicative of great things to come.

For decades, people have been trying to write Von Neumann programs to perform image processing such as recognising a face. Despite utilising extraordinarily powerful computers, supplemented by specialised hardware and intensive programming efforts, little real success has been achieved. Certainly less than would be expected of the average kitten. However, by constructing networks of interconnections that mimic the nervous system, researchers have already met with success that far exceeds that attained by the Von Neumann approach.

Moreover, these neural networks are general purpose and learn by example rather than by programming. They are robust, in that a learned response is not stored in any particular place, but is distributed across the entire net. They are also adaptable.

Much has been written in *APC* and other publications about neural networks, but at the moment, they remain academic oddities. A few companies have released commercial products using neural technology, but it is yet to be widely applied.

The key factor in neural networks is that they can be simulated on Von Neumann machines (as per Alan Turing's theorem), but only very poorly. The simulation job is an order N^2 problem, and for any reasonable number of neurons, the processing and storage requirements become so high that even the largest supercomputers wilt under the strain. Utilising multiple parallel supercomputers simply changes the scale of the problem, but not its order. In other words, for any fixed number of proces-

sors, the operation of a neural network remains an order N^2 problem, and doubling the number of neurons increases the processing time by a factor of four.

Some large technology companies have already fabricated neural network hardware — circuits explicitly designed to be neural networks and which therefore overcome the performance problem of simulation on a conventional computer. These devices have demonstrated a particular aptitude toward solving the problems with which the traditional software industry has been unsuccessfully grappling for decades — and it has been done without thousands of man-years spent coding algorithmic programs.

When push comes to shove

So, will neural network based processing totally replace conventional computers? It seems unlikely, at least in the short term. Neural networks have already started making advancing moves, but accounting is probably still best done using the conventional architecture.

Certainly, 100 issues down the track, neural networks will be fairly commonplace, except for specialist applications where Von Neumann processing fails, and where algorithmic processing is not required.

By the 200th issue of *APC*, the advantages of each technology will probably have been merged, and conventional processors will be assisted by neural network coprocessors — much the same way today's computers contain numeric coprocessors, graphic bit-blitters and SID chips. The core functionality of applications will still be written algorithmically, assisted by neural processing for the user interface and some analytical functions.

One can easily imagine an ATM using neural technology for its speech recognition, video processing and withdrawal limit judgments, while using conventional technology for its cash logs, host communications and device management.

The advantages of this fusing of technology will be manifold. First, the existing unsolved problems will be resolved, without the need for 10,000-mip CPUs. Users will therefore have available to them reading machines that work, page scanners that get it right, and voice input that does not require word pauses and provides an accuracy above the 90 per cent that people seem impressed with today.

As the core functionality remains algorithmic, databases can still be managed with absolute control, and key process-

ing procedures can be debugged and subject to change control. The primary drawback with neural networks is that they cannot be held unchanging, as they function by their internal self-adjustments. Just because a system functions correctly today does not necessarily mean it will do the same thing tomorrow. Of course, it is often reported that Von Neumann machines occasionally do something unusual that they've never done before, when nobody has changed a *thing*. However, these artifacts are inexorably end-user based, despite the inevitable protestations.

Similarly, neural networks cannot easily be debugged. The whole point to a neural network is that it ends up being able to do something that its creator cannot explain how to do. If the task could be adequately explained, it could be programmed.

Another 200 issues of *APC* will take us to issue 300 in the year 2005. IBM will still be around (probably), people will still use PCs, and mainframes will endure with the same techno-snobbery that exists today. PCs and intelligent terminals will talk, listen, understand and be able to draw limited inferences. The Von Neumann architecture PC will

feature at least 200 mips and about 1Tbyte of non-volatile memory (obviating the need for disk drives). Quite likely much of this will be implemented

using optical logic elements. The neural counterparts will be implemented with about one million neurons, giving them an intelligence on par with a bee — a challenge that eludes us today. But those neurons will be less concerned with gathering pollen and navigation

using solar radiation, and more committed to helping people use computers effectively.

Expect the unexpected

Another 100 issues of *APC* past the 300th will see the neural approach gain ascendancy, with the primary processor being neural and having access to Von Neumann coprocessors. It seems unlikely that neural processors will be able to perform the whole spectrum of information processing, as current indications are that they function poorly on the tasks that conventional computers do so well, such as number crunching and repeatable highly accurate algorithmic procedures.

While all of this advancement may have spelt the downfall of your average CICS COBOL A/P, the semiconductor companies will have been going from strength to strength. They will still have been fabricating chips with staggering start-up costs, little production overhead and massive prices — it is just the chips that will have changed.

However, the semiconductor barons may be in for a shock. Already, researchers have managed to construct a NAND gate using biological components

Bob Wallace on what he does and doesn't like about Turbo Pascal.
And what Borland have done about it.

Bob Wallace is the President of Quicksoft, the respected US publishers of PC-Write, and a distinguished software author in his own right.

Writing in PC World recently on the subject of Pascal he stated..."We highly recommend Borland International's Turbo Pascal (4.0). You can get started quickly with this compiler – especially if you purchase one or more of the tool boxes.

It is definitely the best in terms of turnaround time for locating and correcting errors, and it is the only compiler that provides graphics support. The lack of a source level debugger is Turbo Pascal's only drawback, but Version 5.0 of the program should correct this deficiency."

The perceptive Mr. Wallace was, of course, quite right in his prediction. A source level debugger is now part of the newly released Version 5.0. This also has a compile speed of 34k lines per minute. Smart linkers strip unused code and data.

And there's a full development environment including EMS support for editor.

The Borland International Turbo Pascal language range is the most advanced and comprehensive on the market today. The Turbo Assembler is the fastest available, is fully compatible with all 3 versions of MASM (even MASM can't make this claim) and easily interfaces with High Level languages. And there's full 386 support!

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— acids, proteins and that sort of stuff. The NAND gate is, in many ways, the primal logic element. Using just NAND gates, one can easily construct AND, OR, XOR and NOT gates. From those compound gates, one can then build flip-flops, registers, counters, decoders, demultiplexors, memories, CPUs, ATMs, 3090s and any other component in use today.

Computing has been the sunrise industry for about two decades. Innovation precesses innovation and builds upon existing technology in an exponential spiral. Yet our place at the forefront is threatened by people with test tubes constructing the genetic engineering industry whose rate of invention rivals that of computing in the heady 70s.

These two technologies would seem safely removed from one another, but for the spectre of biological logic elements. The high-tech craft of silicon and gallium arsenide fabrication may end up worth nix if some fellow in a white coat figures out how to grow UARTs on a petrie dish. What bittersweet revenge if the whole of mainstream DP finds itself 'rationalised' out of existence by gobs of smelly organic goo!

One can well imagine specialised components grown in an incubator to specification. If it seems unlikely, then consider that DNA contains all the necessary information to construct a unique human being. How much simpler would it then be for DNA to carry the blueprint of something as simple as an 80386 with onboard MMU. Designing organic memory would be even easier due to its regular pattern of organisation. The bio guys are already fiddling around with DNA sequencers and synthesisers (assisted by Von Neumann architecture computers), trying to unravel the complexities of individual genes and hereditary diseases and defects. They might just find cloning the MCA in organics a harmless diversion on the way to their final goal.
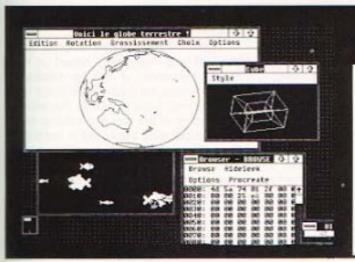
In many ways, the construction of organic logic elements would have marked parallels to the existing silicon fabrication of ICs. The start-up costs would be high as the appropriate proteins and acids are designed, while the unit manufacturing cost would be relatively low. Like silicon, the organic raw materials are abundant in nature. Unlike silicon, carbon-based structures can even self-manufacture in tiny organic factories such as the e-coli bacteria. The mind boggles as to whether organic computers, instead of a lithium battery, would need some form of saline drip to keep the real-time clock running.

The striking aspect of organic computing is that the current research is towards its application in conventional digital logic. Yet the precedent for biological information processing lies in the area of neural networks — just look around you.

It seems almost inevitable that the two should merge, and that the neural components currently manufactured from silicon should eventually be grown organically. Indeed, it almost seems more likely than the biological manufacturing of conventional logic elements. A relatively simple digital component, say a barrel shifter, requires a strict structure which must be precisely achieved for the object to perform its designed function. A neural net, on the other hand, requires little a priori design, as the network should make its own arrangements as its learning progresses, independent of the intentions of its designer but in response to its environment.

Thus, we can look forward to a merging and intertwining of technologies — organic logic chips, silicon neural networks, organic networks, and hybrid logic/neural devices.

THE FUTURE

August, 2030

Five hundred *APC* issues from now will take us to August, 2030. Due to the greenhouse effect, the temperature will have increased an average of 15 degrees, counteracted only by a nuclear winter — the result of an atomic x-ray battle station fortuitously crashing onto Mua Roa atoll due to a decayed orbit. Ozone has been successfully canned as a propellant for fly spray.

Based on all the foregoing, we can expect a very rich computing environment with lots of overlap and an inexhaustible supply of new ways of doing things. The probability of adaptive neural networks raises the possibility of new types of user interfaces, such as a plug behind the left ear into which your 9-pin RS-232Y interface connects (I think we should be back to 9-pins by then).

Currently, this manner of interface is far beyond our abilities — partially because we do not know in detail how the human brain operates and what internal protocols it maintains, and moreover, because we suspect that everybody's brain operates differently. An interface based on an adaptive neural network, however, would be capable of dealing with these problems, and should be better suited to finding a solution than traditional digital logic.

Such an interface would not be a replacement for a keyboard. It would not even be a replacement for an intelligent assistant. Rather, it would be more akin to telepathy with a computer. One's intentions, with all their subtleties, could be sensed and carried out with the utmost precision.

It follows that in the same way computers enhance communications between humans today, such an interface could be used for CAT — Computer Aided Telepathy. Combined with the current investigations into virtual reality, such a (literally) 'person-to-person' call could result in shared experiences over long distances or even a 'store-and-forward' arrangement (not tonight honey, I've got a headache. I'll play it back tomorrow night). The spin-offs in the motion picture and budget tourism industries would be revolutionary to say the least.

The executive work station of the day should look nothing like today's PC. One possible configuration that can be envisaged are two trays on the top of the executive's desk — one labeled 'in' and the other 'out'. Speech recognition and speech synthesis will be solved problems, and in every day practical use. Video image processing will be used to assist speech recognition and enhance user-friendliness by allowing the workstation to interpret body language and visually gauge the bosses disposition.

Documents that require action are simply placed in the in-tray. As the document is inserted, the executive mutters to draft the standard reply, but make it sympathetic. The resultant document is then delivered to the executive's out-tray. The printing device will be full colour, full page, photographic quality which can sheet-burst, decolate and bind. Once the reply is approved, the document is communicated to the recipient's workstation and delivered into his in-tray.

A screen placed nearby will provide video communications with other people, television reception, and optional interfacing with the workstation system.

Certainly, much of this is possible today, but by 2030 it should be in general use and working correctly.

Home use of computers will be mainly through the combined use of the videophone and television console with its optional CAT interface. The integration of computers in the home should be as thorough as that of the telephone today — almost complete, but not absolute.

On the other hand

If much of the above sounds reasonable and likely, then based on historical precedent, it can be dismissed as being way off track. Technology has a disarming habit of taking the wildest projections of the day and making them look desperately backward in hindsight. X-rays were one such example of this, and undoubtedly there are other developments which are presently laboratory curiosities that will emerge as world changing influences. Superconductivity seems poised for just such an action.

Other times, technology takes seemingly simple advancements such as speech recognition and keeps moving them forever out of reach.

No doubt the computer industry 500 issues from now will be a mixture of these two phenomena. Some research, which has been proceeding for years and appears to be on the brink of success, will still be unfulfilled, while other, completely new and totally unexpected arenas of opportunity will fall right into our laps.

If we can only agree on how many pins should be in an RS-232 plug, I cannot help but maintain the highest optimism.

END

THE
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Microsoft's Bill Gates

Microsoft is arguably the most influential software
company in the PC arena: its strategic alliance with IBM has produced
MS-DOS and OS/2, plus a large number of applications. Microsoft's
Chairman Bill Gates was in Sydney recently, so we asked Phil Cohen to find
out what Gates thought the state of the industry will be in eight years' time,
when we publish the 200th issue of APC.

APC: Partly thanks to Microsoft, we now have Mac-like interfaces on Macintoshes, PCs and many other machines. What lies beyond the mouse?

Gates: You can look at things that proceed in a linear fashion, and those are pretty predictable. For example, the resolution of the screen; you can go up to two pages per screen, and you can have a great deal of colour, plus grey scale for an incredible amount of sharpness. Those features will be common even on portables; even the battery powered ones will have incredible resolution. I think that the mouse and graphics interface will become so standard as not to be even an add-on.

APC: So much for linear things. But when we talk about the man-machine interface, there are some non-linear things: like the way in which we moved from the teletype to a full screen interface, and from a full screen interface to graphics. These really were qualitatively different ways of working with the machine, and they opened it up to more applications and more people.

Gates: There are at least two things that will have happened to the man-machine interface in the next eight years (which is a long time in this industry), which repre-

sent non-linear moves: handwriting and voice.

Let me take handwriting first because I expect that to happen earlier — in a four or five-year time frame. A keyboard is limiting, and the separation of the input and display distracts the user. But imagine a machine a little thicker than a pad of paper but about the same size, and a stylus very similar to a pen. The idea is that you sit and write your notes; you can draw little graphs and diagrams, and you can even page back to look at your previous notes.

APC: We ran a review in our October issue of a machine called the Linus Write-Top, which has a graphics tablet in place of a keyboard.

Gates: There are many such prototype machines. In fact, that is one of the nice things about our industry — most of the things that are popular now were around in some super high-priced niche some years ago. A lot of what we do is to bring stuff from expensive machines down to the mainstream.

The mouse is a sixties thing, and twenty years ago researchers were developing group productivity concepts that we're just delivering today. There are a number of people playing around with

handwriting input right now, and although it's not yet mainstream, it will be in the next few years. I'll certainly carry one round at all times.

Having to look at the keyboard, and look at the screen, and carry on a conversation, is impossible: it's just not simple enough. Imagine just being able to delete just using editing marks.

I love the idea of being able to call up the definition of a word, or scribble something down during a conversation. I don't mind a keyboard but I sure love paper; paper is a hot medium. Very free form.

The other key input technology will be voice; that's harder for me to predict because it will be taking place in the four to eight-year time frame. I think it will be fairly widespread, but people have been over-optimistic about this one, like most things.

APC: The machine has got to almost understand the conversation in order for continuous voice to work, but fortunately we can rely on the human to adapt to the machine, to some degree.

Gates: It's a top problem, but I am not talking about arbitrary speech. I am talking about sitting there at the machine and being able to say "show me the Smith customer file" or "how are sales

doing?" That way of talking to the machine will be understood very well. Even in the office environment, which is fairly noisy, and even with multiple speakers and a vocabulary of 3000 words, which would allow you to do this office automation interaction very nicely, speech recognition will have a high enough level of accuracy that you'll feel good about using it. That means a 99 per cent level of accuracy, because people's willingness to deal with things that randomly fail is incredibly low.

That's, incidentally, why some of the systems that demo so nicely are not popular. Apricot in the UK had a machine based on voice input. I thought they had done a pretty nice job. I thought the thing might do well. But it didn't, and they eventually took a fairly substantial write off — because the accuracy rate was too low. Actually, the people who did that technology will continue to refine that technology.

It's mathematically understood how to do some of this stuff, it just takes very high speed processing, and we're going to need a lot of the brute force the semiconductor industry will be giving us in the next eight years.

APC: That brings up another interesting question, about multiple processors.

There must be an upper limit to the linear increase in processing speed using the same technology or series of technologies. Surely the only way to achieve a qualitative increase is to have multiple processors?
Gates: Well, in the time frame we're talking about it looks like unit processor performance can continue to grow at a greater rate than it has in the last period of time.

That sounds pretty amazing, but there are some nice tricks. The '386 machine today is about a five mips, let's say six mips, and what I'm saying is that for an equivalent price you'll be able to buy a 60-mips machine, in well under eight years time; more like five.

For example, you can have a processor chip in which there are, say eight 'execution units'. The instructions come into the chip in a series, and each of these execution units is looking at one of the instructions that's come into the processor, and trying to find instructions whose inputs are already computed. When it does, it computes the instruction.

Now, typically, a lot of these execution units will be empty, but if you're clever about changing the instruction set and changing the compiler, you can avoid what is called interlock, which means

waiting for the results of something early to do something later.
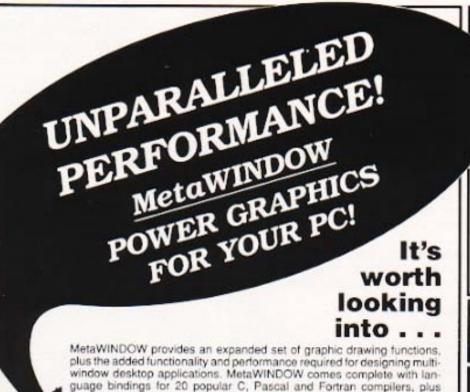
APC: That's not very far from multiple processors.
Gates: No, it's not. The difference is that when you state the problem there's one single logical stream of execution. That's why it's not multiple processors. It's also on one chip.

Now let's look at what this does for the mips. If we run a '386 at 25MHz, with four cycles per instruction, that's about six million instructions per second. Then we go up to a '486 at 25MHz and we run it at two cycles per instruction and that would give us 12 mips.

Then we take a RISC processor, running at 50MHz at one cycle per instruction, and that gives us 48 mips. But this multi-execution unit processor can do more than one instruction per cycle. If, for example, we get three of these execution units firing at each cycle, and we run the processor at 50MHz, this gives us 150 mips. This is pretty interesting because today the fastest unit processor, a 3090 mainframe, is about 16 or 18 mips.

There are a number of RISC type designs that are characterised by multiple execution units, usually based

THE FUTURE

around RISC. There are a lot of people trying to take the performance lead here. Sun has the SPARC, Motorola has the 88k, and Intel has its own way of playing in this game. IBM has its own proprietary version of this, and HP has one called Spectrum. One of the problems with this type of work, though, is memory bottleneck.

APC: Can't you do the same thing with memory as you're doing with the processing?
Gates: Essentially, yes. The memory sees a set of requests and it figures out which requests use different chips.

There are two other tricks in memory. One is to widen the bus so you're fetching more bits at the same time; buses today are typically 32 bits, but by the end of your eight-year period they will have gone up to at least 256 bits. That's a big win, a factor of 80.

The other major trick is caching, where you have a small amount of extremely fast memory close to the processor, and that speeds things up a lot, especially if you have different caches for the stack, data and code.

APC: Where do you think mainframes will be in 10 years time? Their advantages now seem to be mainly as a central store of data rather than an actual processing unit. Would you agree with that?
Gates: Yes — today, mainframes are already mostly specialised for storing lots of data, and as we move out to the future that'll become 90 per cent of what they're doing. However, there will still be a few things like weather prediction and some sorts of optimisation where you'll look at them as big concentrations of computer power.

There are basically three tiers of data storage: personal data storage, departmental data storage and enterprise or company- wide data storage. There needs to be a company-wide machine that can store all the transactions, customer lists, payrolls and be able to give you that information in an incredibly fast fashion. The mainframes that will be popular in the future will be the ones that do that well.

If all of those machines are properly interconnected, you will be able to access all the information on all three levels from your personal machine. If we get the interface right you can sit down and ask questions like: "Are there any interesting articles about this?" "What's happening to our competitors?" "What is this project plan, what problems did we run into with this schedule, why weren't our sales higher, why did we spend more

than budget?" To answer any of those questions, you should be able to click a few times and type a little bit of text and get something up on the screen.

APC: Microsoft isn't very active in the mainframe connect market.
Gates: That's true, but fortunately when you want to access mainframe data there is a standard called SQL, which is part of IBM's SAA standard. Our primary strategy is to implement tools and products down at the PC level that issue SQL requests. Actually, we haven't even shipped these things yet, but they do form part of our strategy.

The alternative is to try to connect each PC application individually to each mainframe application, and that's a lot more work.

You will eventually have a number of PCs connected in a LAN to large departmental-level server machines, which will talk to the mainframe via SNA or OSI standards.

APC: There is currently a lot of talk about 'virtual reality'. Basically, this is a user interface in which you put on a helmet and a pair of gloves. As you move your head, the computer presents you with different views of reality through screens in the front of the helmet, and as you move your hands you can alter the reality. Do you think that type of user interface will be important?
Gates: Absolutely. There's a great deal of power in the idea of being able to visualise things. For example, there's an application for that in understanding protein folding, in which molecular biologists will able to look at molecular models and toy with them, reach out and grab them and twist them around.

But in terms of volume users, no, I don't think it will catch on for manipulating commercial data.

APC: What about entertainment use?
Gates: I think we'd be getting out beyond eight years to get that. But while we're talking about entertainment, there are going to be a number of advances in that area.

As I've said, there are linear changes in terms of graphics resolution, and some non-linear stuff in voice and handwriting. There are also some linear trends in terms of memory size, where we will go up from a megabyte being typical to eight megabytes being typical.

But it's in the permanent storage capacity of the machine that we will see such a dramatic rise that it leads to a *qualitative* difference in the way we use the machine.

Today, we use floppy disks which typi-

cally store around a million characters. Then we have hard disk storage, of around 20 million characters. That lets us deal with the programs we want to buy and the data we generate oursel- ves.

APC: But we don't store video and audio on our PC today because of the capacity required. If you just multiply out, a moving picture with a 1000 by 1000 resolution and 24 bits per pixel, and 20 frames per second will need 60 megabytes per second. One second of that video would take up your entire disk.
Gates: Fortunately, it's not that bad. There are ways of encoding video in which you take advantage of the fact that you have a lot of spatial continuity, because colours don't change all that dramatically as you move in either direc- tion in the picture. Likewise, you have what's called time continuity: as you move from frame to frame, the picture doesn't change that much. Those techni- ques allow us to get about a factor of 300 down from the 60 megabytes per second. Even so, it will take 12 megabytes to encode a minute of video.

It's only when you use compact disk technology that you can start to talk about storing audio and video on PCs.

The compact disk used to store music today stores 540 megabytes.

That technology was put together about six years ago, but without pushing it too hard it could go up to about eight gigabytes easily. The people that developed the audio disk didn't push the thing. They went for about an hour of audio because the music industry didn't want more capacity; in fact they had a bad attitude toward more capacity. The so called DAT Digital Audio Tape has about a four gigabytes data capacity. And of course you can make bigger tapes.

When I say that number 'four giga- bytes', people don't realise that that is qualitatively a different world. I describe that to people by saying it's an entire en- cyclopedia with pictures and audio. But until you sit them down and show them the world spinning around and they click on a country and see the map of that, and then they go into any village and see the hotels and restaurants and tour things; until they're actually interacting with that wealth of information and have it come up in some video or audio fashion they can't really appreciate it.

So we'll have a class of software quite different to today's software. Today's software is mostly computer instructions

that, when you run them, give you a lot of power — but a blank screen. It's up to *you* to do something.

In this new world the information is there and what you're doing is indicating your interests and your preferences. It can devolve into simply a passive TV session, or it can be more like an en- cyclopedia or auto parts catalogue.

APC: That concept of browsing and going from document to document sounds like hypertext.
Gates: Hypertext is the idea of allowing you to move around a set of information in a variety of ways. Hypertext employs the user to do that traversal, and so the software itself is still passive.

Eight years is so long in this industry that I may sound like a madman, but I think that in that time your car will have a CD that has a complete set of maps, all the map information will be digitally based and you'll be able to type in where you want to go and get a route. That will be a very inexpensive add-on to your car. And it'll have more than just a road map. Things like restaurants, hotels, and so on will all be in there.

APC: Microsoft has said that its part of the strategy is to produce applications

that run on PCs, Macs and presumably anything else that looks like a winner, and have data interchanged between them. But today you can't take a disk out of a Mac and put it into a PC unless you buy another piece of hardware, or put your data through a piece of wire. Do you see any increase in standardisation in disk formats?

Gates: There are two problems there. One is that as we improve the form factor you get discontinuities, as is happening now as we go from five and a quarter to three and a half. Quite painful. Within the three and a half inch realm there's still the fact that Apple can't read IBM three and a half inch disks. That's just an error on Apple's part that they need to fix and they should move quickly to do that.

In fact, with their very highest machine they have introduced what is called Superdrive, but they didn't integrate the ability to read those disks in a very straightforward way. They are working on that. They'll get that straight.

Within the three and a half inch world all you have is upwards compatibility. We started at 100k, and currently we're about to go to two meg. I don't think we need to move to a different form factor. There will be people who say let's get smaller, but I certainly hope we stick with this one because it's pretty decent.

Someday — not even in this eight year time frame — we'll get a single media, and every time you take a picture, take a film, or make a recording, it will all use the same media. Just one media; and all the impressions you ever buy or create will be in one library in your house.

What you need for standardisation of a medium is so much capacity in that medium that specialisation no longer makes sense. That unification can only happen in the digital world, by the way, and currently in consumer electronics the only thing that is digital is compact disk audio, everything is still analogue, which means it's very specialised for the type of thing it's trying to record. But as all that stuff moves to digital, there will be an impetus to get a unified bit storing medium.

APC: Software is getting more and more complex: some of the things in OS/2 look like they came straight out of mainframe operating systems. To run mainframe operating systems you need a small room of experts down the corridor — do you think PC software will get that way?

Gates: Certainly not.

APC: What's going to stop it?
Gates: Well, we'll just have to keep it simple. I suppose to an extent you're right, we sort of have moved a little bit in

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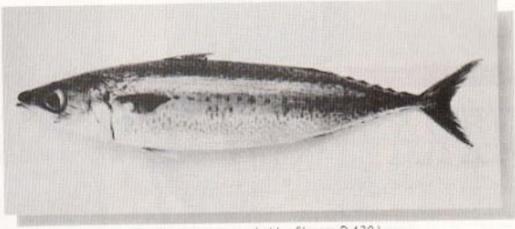
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the wrong direction. These CONFIG.SYS files with funny parameters that need a genius to drive them; that stuff has just got to go. Apple has done a better job in watching out for this stuff; oh, fine I can criticise their stuff, but on balance they have done the job and it's certainly proof that we can do it too.

Also, we're not trying to turn PCs into mainframes, although, underneath them we're certainly going to need the same concepts. OS/2 does implement mainframe concepts down at the PC level. We need to mix it with interactivity and simplicity, and avoid the mistakes of the past, and do even better.

Your car engine is incredibly complicated and most people don't understand it — its complexity is hidden from the user. We have to make our software like that, somehow.

APC: Why didn't the mainframe industry manage simplicity?
Gates: There was no reason for them to. The truth is that when you're paying 13 million dollars for a machine, the idea that you need an expert there to squeeze the last five per cent out of it doesn't sound too strange. Also, you have to understand they came from an era where they made performance

tradeups in a different way. For example, when you create a file on a mainframe you tell the system how big the file is going to be, and later if it gets bigger you have to declare another partition for the thing.

Inside your little PC, as you grow files, they just get bigger — the operating system looks after creating new places for them; sometimes you're paying a performance price for that. But on balance you'd rather just never worry about the burden of trying to predict the file size.

Mainframes came from days when things were slow, and the work was harder because they were trying to squeeze the last ounce of power out of the machine. So they did things differently.

APC: There seems to be a limit to the functionality that can be built into applications, simply because there's a limit to what people are prepared to sit down and spend time learning about.
Gates: Yes and no. When we started doing the word processor I didn't have any publishing background so I thought it would only involve wrapping words and splitting pages. Then they tell me about side heads, and kerning, and ligatures, and algorithms to make sure you don't have multiple hyphenation points in

a row, and wrapping around irregular objects.

People will want to use every one of those features, and that the feature list is driven not by the software, but by the needs of the users.

APC: That sets the lower limit of functionality, but what about the upper limit? Will there ever be a limit to the number of bells and whistles you can stick on your application to make it better than somebody else's?
Gates: No, but what you want to do here is to make the very common things built-in and then allow for extensibility so that no matter how unusual a thing people want to do they can put it in there.

That means what we sometimes call programmability, or opening the architecture. The early equivalent of this was the macro capabilities in spreadsheets, which dared a lot of users to go pretty far. Many office workers have latent creativity; you give them a tool like this [and] they go so much farther than you'd expect. There are a lot of users out there like that.

That's part of the fun of this stuff, to have people who take it to its limits. And then you realise that there seem to be a lot of people trying to do x to our

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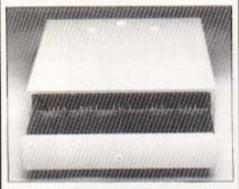
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product. We should build it in instead, we should make it easier.

APC: Documentation is a subject close to my heart because that's what I do most of the time: today a lot of companies are releasing decent manuals, and Microsoft is one of them, but still the bookshops are full of books to explain how to use software products.

Gates: I don't think they have to buy books.

There are a couple of improvements that are taking place, one of which is the electronic tutorial, which some people love and others hate. But with CD capacity, things will definitely change for the better. Imagine getting a Works disk; when you plug it in a person comes up and says here's one way you can use Works, and they show you some sample things they've done. When you see one that's relevant to you, you click on it with a mouse, and then they teach you the product, with the goal of helping you prepare the thing that you chose.

That's far more interesting than: "a cell in a spreadsheet holds a formula that is made up of constants and operators, blah, blah, blah."

APC: Cellular telephones now allow people to wander about and be on the end of a phone all day. The same technology could give you a portable computer with unlimited public database access.

Gates: I am one of those people who use cellular phones because I go nuts in traffic otherwise. But you know, typing and driving is not such a safe thing.

We can probably find some madman who's running around using a cellular computer like that, and perhaps in the future that notebook computer that I talked about will have a few lights on it to tell you that urgent mail has been sent to you.

APC: Are we again reaching the limits of what people need out of technology, rather than the limits of technology itself?

Gates: Not really. It appears that way from time to time, but the world is still inefficient.

It's just that technology is a little like pure science: it's hard to imagine where things become useful; when they're first discovered they're rarely of value.

We're in the information age so it's easy to imagine being overwhelmed by a ridiculous amount of information and a ridiculous access to information, but that's probably because you're imagining trying to access it through the current techniques.

In terms of the interaction between technology and society, there are some tough challenges that technology puts forward. We had a little problem with software copyright, but that was basically taken care of.

Networks are going to make the notion of intellectual property far more difficult than it has been. But I have no doubt the law will eventually catch up with that.

But there are going to be some incredible security issues. Right now, you can walk out of your office without locking your door because if somebody comes in and starts rifling your desk your co-workers would stop them. But with the electronic equivalent there's no picture up in the upper left hand of your screen showing that the files of the guy next door are being rifled.

APC: Is it possible that formerly creative areas like page layout and design are going to be automated in the future by the use of expert systems?

Gates: An expert system is a piece of software which expresses knowledge in the form of rules. Programming using rules is called 'declarative programming', where you tell the computer a number of things, then let it work out its own solution to each problem without specifying just how it's going to do it.

APC: Will this be used in say, mainstream office automation applications?

Gates: Absolutely. We want to raise the level of knowledge inside the machine up from its knowing about the Nth character of line x, to at least the basic concepts of office automation. When I ask my chief financial officer to do up a report or investigate something, I keep all the electronic messages I send to him. And I figure out how much knowledge of the world it would take for me to be able to express these requests to a machine.

It takes a fair amount of knowledge, things we all take for granted like customer, important, monthly, notions of time and priorities. Human common sense is a tough thing to replicate, but maybe in the office environment we can get enough of it to improve the way we interact with the machine. And these rules are a way we can build in that fundamental knowledge, and in a way that users will be able to customise.

There's an even more tricky thing — machine learning — in which having seen things on a regular basis, the machine can generalise. If you have an office assistant for a year, you can give him or her very terse commands. The depth of generalisation that even an average office assistant needs to have is incredible.

The idea of learning and generalising is

THE FUTURE

an even more difficult one than the idea of being able to store knowledge in this declarative form. Both those are things in which very interesting work is going on. It's very hard to predict because all the predictions of the past proved to be blatantly over-optimistic. And unlike CD-ROM, where I really know what the steps are, with learning and expert systems there have to be some breakthroughs. I feel like we're on the verge of that, but just being in the industry makes you want to feel optimistic. So it's hard to know how quickly this will proceed.

APC: On a similar tack, neural networks are another way to produce machine learning. Do you see applications for those?

Gates: The brain is made up of neurons. Science does not understand even the most simplistic notion of how a neuron changes state over time to store knowledge and learn. We don't understand the first thing, even at the chemical level. So when we call things neural networks and speak as if they are an analogy to what's going on in the brain, we don't really know the first thing about it. It's clearly a much more complex mechanism than so-called neural computers.

Learning is not just going to magically happen. We're going to have to figure out what it means to generalise and come up with the algorithms for that. It is one of the great problems of all time.

The brain is the slowest computer we know of, and individual connections and communications move at incredibly slow speeds, a thousandth of today's machines, and yet we can't even pretend to pattern match even trivial things like chess games today. The claims that are made for that stuff do upset me sometimes.

APC: I should ask you a little bit about what Microsoft will look like in eight years time. Will it still be a PC applications and operating system company?

Gates: In terms of our product set, we'll be able to deliver more to our customers than just the program code: the code will be only one element. Delivering things like teaching elements for a specific context, that'll be very important. And we do hope we will have all these activities on CD-ROM.

We also hope to deliver information products. This will be a new type of product that no one company that exists today can deliver. It's going to need some combination of software companies, and publishing companies, and movie companies to build multi media titles.

Now we're investing millions every year to figure out what those skills are and how we can be part of that, and I hope in eight years we'll be delivering some of these products, in the form of encyclopedias or titles on sports or medicine.

APC: It's easy to see applications in things like encyclopedias and lists of sporting achievements and so on. I suppose it's more difficult to predict what new forms of publication this sort of medium will open up.

Gates: That's true. When you get a new medium there's a tendency to simply map onto it material developed for the old medium. The original TV shows were simply some guy sitting there and reading, just like on the radio. And in fact if somebody had come along and tried to do the visual things we do on TV today, the audience wouldn't have been ready for it.

So okay, we can think of shopping catalogues on the CD because we already know about that, and yellow pages and travelogues, but users might, for example, want to pull stuff together themselves and create their own titles. How creative are people, how much do they want to play around like that, given

incredible tools to do it? It's really an open question.

APC: You're working on OS/3, the '386 version of OS/2. What will the future hold for that type of product? OS/3 is going to be pretty old hat in eight years time.

Gates: Actually, the name is not right. It will be called OS/2 for the '386, and it'll come out in '89. But you're right, in eight years time it will be old hat.

APC: So what's next?

Gates: Well, there are some pretty straightforward things. Allowing the operating system to work in a situation with many processors working together.

You currently think of the information in your computer today in terms of files, with cruddy names. The computer is not helping you to remember what information it actually holds, and if a file has different types of information in it you have to be brilliant about moving it around between the applications.

There's a term called 'Object Orientated', which is going to be massively over-used in the next five years, but underlying it is something of great importance; information can in a sense be self-describing. This concept gives us a lot more leverage in having different pieces

of code deal with wide varieties of data. You will be able to view the data you have on the machine in a much more flexible fashion. In fact you'll think of it as a database of all your information, rather than all these little file names.

APC: Hewlett-Packard is doing some work in that area.

Gates: Yes, there's a thing called New Wave that is a first generation of this notion. You still think of files, but the way the files embed different types of information is very flexible. Everyone knows the direction we're going in, but you have to go a lot further than they have because they haven't addressed the network and they haven't addressed the top level and they haven't addressed how it changes the applications, but they're doing some good work.

APC: I don't have any more specific questions. Are there any areas you'd like to talk about?

Gates: No, I think we've hit most everything.

END

Phil Cohen is a director of Hard Copy, a Sydney technical writing company.

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The world language

As we advance technologically and become more dependent on information, the need for a universal language grows. Of what use are communication satellites if we can see, but not understand the language transmitted? How can we exploit the impact of world-wide computer links if users cannot understand one another immediately? Before we can answer these questions, Isaac Asimov believes we must first accept a 'world-wide language'.

If we want to consider what the world might be like as the 21st century proceeds through its first decade, we are faced with an infinity of choices. The economy, the environment, the rain forests, the nuclear race, energy — where will we stand with respect to any or all of these?

One can only speculate; only talk of probabilities. After all, a great deal depends on our actions now, on unpredictable developments, on unforeseeable circumstances.

But suppose we choose a small (but very important) segment of life and see if present trends indicate some nearly-certain consequences. Consider language.

Throughout history, there have been languages that have risen to importance outside the area in which they developed. Either because a particular group was culturally inventive, economically active, explorationally adventurous or militarily successful, the language of that group might expand and come to be used over a considerable region. This served to

help unify the region culturally, economically and politically, until such time as the region collapsed through internal decay or external aggression.
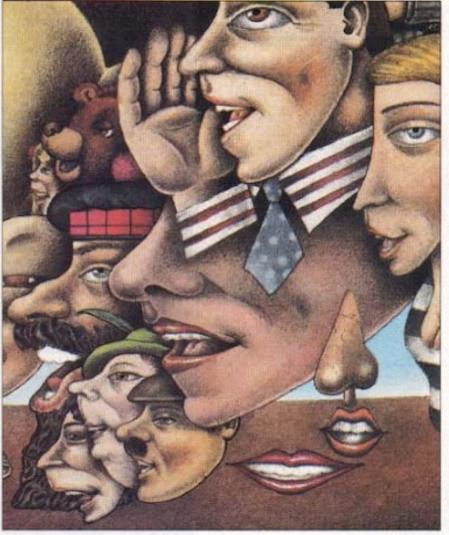
In early historical times, the area that could come under the influence of a particular linguistic group was small. About 2500 BC, Sumerian was the unifying language of the Tigris-Euphrates valley and Egyptian of the Nile valley, but both unified regions were quite small.
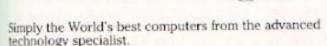
As technology advanced, however, and as methods of transportation and communication improved, languages expanded over larger areas and greater populations.

In our own western civilisation, there were two dominating languages. Between 300 BC and 600 AD, a period of nearly a thousand years, the Greek language was the dominating language of the eastern Mediterranean. Greece itself and Asia Minor were thoroughly Greek in language, and educated classes in Egypt, Syria, Babylonia, Judea and Persia spoke Greek. Even some educated Romans spoke Greek, and it was this which enabled Greek culture and thought to pervade the west right down to

the present day, so that our thinking is still entirely Greek in many ways.

In western Europe, however, Latin spread and from 100 BC to 1700 AD, it was the universal language of educated classes from Ireland to Sicily. Even as late as 1687, when Newton wrote his great book in which he introduced the laws of motion and of universal gravitation, he wrote not in English, but in Latin.

It was Latin that made medieval and early modern Europe a single civilisation, and that made it possible to found modern science. Perhaps Latin would have continued to remain *the* European language if education had not been confined to males. Since females learned Latin only in the rarest of cases, and since communication between the sexes had to be maintained, even the most learned men had to be fluent in the 'vulgar' tongues as well. Eventually, Latin broke under the weight, and Europe became a melange of separate languages (though, for a while in the 1700s and 1800s, French became the language of polite society throughout Europe).

Olio of languages

Two revolutions converted the matter of language from a regional phenomenon to a world phenomenon. First was the Age of Exploration in the 1400s and 1500s, which began the process of placing the world under European commercial domination. Then came the Industrial Revolution, which greatly multiplied European power and placed the world under European military domination.

It meant that European languages — English, French, Spanish and German, in particular — expanded enormously. They were matched only by three other languages of nations who had expanded by land as Europe had expanded by sea. These were Russian, Arabic and Chinese.

No one language truly dominates, however, for we now have a world economy, and the interests of the large nations span the globe. Yet even Chinese, spoken by a billion people, is understood by only a minority of the world's five billion.

The multiplicity of languages encourages misunderstandings, slows trade, pours sand into the wheels of the economy. The time has come when nothing but a world language will do. By this I don't mean that all human beings will speak only a single language; for that would be a deadly blow to cultural richness and variety. It would be useful, however, if everyone, in addition to a native language, could also understand and be understood in a world language.

Modern technology makes this the more important. Communications satellites have made it possible to span oceans and continents as easily as a shout can make itself heard across the street. People in any one point on the globe can be instantly aware of what is taking place anywhere else, and this ability would be largely negated if we could see but could not understand the language.

Again, computers are in the process of binding people together. It is already a fact that computers can communicate with each other all over the world, so that Australia is as close to New York as Philadelphia is in some ways. (Fortunately for the Australians, not in all ways.) This ability cannot be exploited to the full, however, unless all these places in immediate contact are able to understand each other at once. What meaning is there in transmitting information if the information is impenetrably hidden?

THE FUTURE

Towards a universal language

How can we establish a world language, however? It cannot be done by force or by fiat. To attempt it would make people rally around their own language defensively. History shows that people themselves must *voluntarily* adopt a new language as they see the cultural or economic advantage of doing so. Thus, the Cappladocians once adopted Greek, the Gauls once adopted Latin, the Egyptians once adopted Arabic. Or else, a new language arises out of a combination of several contributing tongues as 'lingua franca' became the language among traders in the eastern Mediterranean and as 'pidgin English' became the language among traders in southeastern Asia and the Pacific.

Can we look into the future and see whether either alternative is likely to happen?

Consider that second only to Chinese, in the terms in the number of those who can speak it, is English, and that English has an advantage over Chinese — English is world wide whereas Chinese is restricted, largely, to eastern Asia.

Thanks to the colonising activities of the English in early modern times, English is spoken not only in the British Isles but in most of North America, in southern Africa, in Australia and New Zealand, and among educated classes through much of Black Africa and southern Asia.

Because of the military and economic strength of the British Empire and of its offshoot, the United States of America, English has replaced French as the language of diplomacy; has replaced German as the language of science; and has become the universal language of business and trade throughout the world.

This is seen easily whenever television shows us the leaders of foreign nations expressing their views, as (with the occasional exception of the French and the Russians) they invariably speak in English. Even when people in the street are asked for opinions they can, in a surprising number of cases, express themselves in English.

What it amounts to is that English is *already* the world language. In many of the small countries, English is universally taught as the easiest way to open doors in all the world. (Norwegians, generally, speak English better than Americans do.) In Japan, all my books are translated, even those that deal with the English language. When I asked why the Japanese should be interested in books dealing with the derivations of English words from Latin and Greek, I was told that Japanese were proud of their ability to understand English.

If the world economy does not collapse, if nuclear war, over-population, or any of several other ills, do not ruin us all, this is bound to continue. As Greek was once the language of the eastern Mediterranean, and as Latin was once the language of western Europe, so English (in different varieties) will be the language of Earth, *without*, it is to be hoped, wiping out other languages.

The advantages of this are self-evident. However, it would not be realistic to expect too much to be achieved by this.

Certainly, it seems reasonable to suppose that different people, speaking the same language, will be readier to see their own similarities. Xenophobia may be reduced, but it will not be wiped out.

American Blacks speak English as do American Whites, but racism is still a problem in the United States. Civil wars between factions, speaking a common language in a single country, can be more violent and unforgiving than wars between peoples who speak languages that are mutually incomprehensible.

If we want a modern example, consider the decades-long battle between factions in Lebanon, all of whom speak Arabic, and between factions in Northern Ireland, all of whom speak English.

A world language will do much good, but it is not a universal panacea. To bring about a kinder and gentler world, there will still remain a great deal to do.

END

"Quiet everyone—let the crystal do its work."

The human touch

How user-friendly do you find your computer? David Tebbutt talks to Bill Buxton of the multi-sensory interactivity and integrated media department at the new Xerox European Research Centre, who believes that, whatever the manufacturers may say, there is great scope for improvement in the human interface in the coming decades.

Xerox's Palo Alto Research Centre (PARC) has been thrust into the limelight by Apple's popularisation of its WIMPs user interface. Like most good ideas, this one has been latched onto by almost every hardware and software manufacturer, with the result that even better ideas are in danger of never emerging from its shadows.

Instead of being just the beginning of a whole new way of using computers, the Macintosh style is being treated as the end point. You only have to compare the working methods of a conventional artist with the convolutions required to use MacPaint or PC Paintbrush to see how impoverished the computer approach is. Having said this, though, the computer does add plenty of very real advantages, especially for those less skilled, whether in art, music or any other area.

Xerox PARC continues to conduct research into a wide range of activities and potential products and has complemented this with the establishment of a systems research laboratory, Rank Xerox EuroPARC, in Cambridge, England. This laboratory is specialising in human-computer interaction, the very area which produced the famous WIMPs.

When you think about it, the user's view of a computer is strictly limited by what they enter into it and what they get out of it. What goes on behind the scenes can be appreciated, in the same way that a car engine can be ap-

preciated, but it doesn't need to be understood in any detail. The real action takes place through the user's hands, eyes and ears. Taste and smell do not yet seem to be on the agenda.

EuroPARC's research mission is to make systems more useful and usable by understanding how people go about making use of systems, how designers go about designing them, and how systems are evolved through application and re-design. EuroPARC is primarily concerned with the processes that shape systems, and then in the development of tools and techniques to aid these processes: it does not exist to make computers usable, it exists to make them useful. In order to gain the broadest view possible, EuroPARC's staff are drawn from a wide range of disciplines, including social science and anthropology.

Although the end products of EuroPARC's research may appear to be technical innovations, some other products will be the insights gained into the way people behave with, and react to, the new systems. This information could, for example, be very important to those entrusted with framing employment legislation or to unions thrashing out new work practice agreements. These insights are being made possible by making the entire EuroPARC building a laboratory and using the centre's own staff and visitors as guinea pigs.

EuroPARC is presently organised into

four separate groups: Multi-sensory interactivity and integrated media; Tailorability and system development; Understandability of object-oriented systems and languages; and Support for collaboration and communication. The first of these, and the subject of this article, centres around vision, hearing and touch. The second group recognises the need for users to participate in the tailoring of their computer systems. The goal of the third group is to design more usable object-oriented architectures. And the fourth group is interested in how communities of users collaborate and communicate with each other.
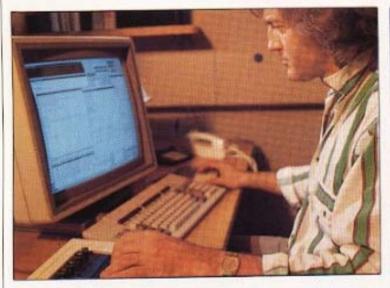
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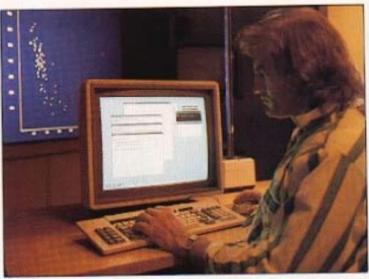
Bill Buxton, a research scientist and the spokesperson for the first group, firmly believes that, by the 1990s, the Macintosh will be regarded in the same way that we regard Cobol today. He's not knocking the Mac — he feels the same way about Open Look and Windows. He thinks that the consumer is being sold short by manufacturers who hide behind a convenient smokescreen of 'the consumer doesn't want more' or 'there's no demand'. The truth is the consumers probably *would* demand more if they had some way of identifying and communicating their additional requirements. (Perhaps readers would like to treat *APC* as a clearing house for their own ideas.)

Buxton is full of suggestions and practi-

Many computer hardware configurations make use of only one hand. Here, Buxton keeps one hand on the mouse, while the other uses a touch tablet. Another idea — a data projector displays information which can be jointly modified by two or more people

cal examples of how the user interface can be improved. He likes to illustrate one of the inadequacies of MacPaint by painting down to the edge of the screen, swapping icons for the non-intuitive 'hand' to slide the page up, then switching back to the brush to continue his work. He suggests that a dramatic improvement can be achieved with the use of a couple of touch tablets lying on the desk in easy reach of the left hand. By touching one, the screen jumps to the same relative position in the 'paper', and by stroking the other, the screen scrolls smoothly, without the user needing to let go of the brush. Details of such a device were first published in 1980.

Now the touch tablets may not be the best interfaces in the world, but they do give users a great improvement over the current methods, because the right hand can continue with the primary task — painting — while the left hand deals with the secondary task of paper movement. Even with today's computers, which can only handle input in a serial fashion, this approach hardly interferes with the computer artist's flow of work.

Buxton sees gestural language as being as important as, if not more important than natural language recognition. We all, regardless of nationality, can benefit hugely from implementations of what he would claim is an even more natural language — that of gesture and touch. Buxton showed a few examples of gestural interfaces which were perfectly clear, yet required no understanding of any particular language.

In the first example, he created a number of triangles, blobs and squares on the screen. He then circled a few (using a mouse) and ran a trail to a new location. All the items in the circle moved to the new position. Two concentric trails allowed him to delete only those items which lay between the trails. The example is meaningless; it simply serves to demonstrate the power of the underlying ideas.

The principle could be used for editing manuscripts on-screen. What could be more natural than circling text that you want to move and then trailing a line down to the insertion point? Release the button and — bang! — the enclosed text is moved. The same goes for deletion. Circle the text to be released, trail across the marked area so that it's dissected,

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> 'EuroPARC is primarily concerned with the processes that shape systems . . . it does not exist to make computers usable, it exists to make them useful.'

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release the button and the text is removed. Why make proof-readers learn word processing's convoluted ways when it's possible to implement their everyday gestures? The first instance of this approach to text editing appeared in 1957. A text editor using these techniques was written in 1969, but the economically available technology had still not caught up with the ideas.

In another example, Buxton wrote musical notation on-screen using a mouse. He started a line at the position on the stave where he wanted the note and drew upwards for a crotchet, terminating the line with single or double lines to signify quavers and semiquavers. A semibreve is drawn with a horizontal line, and a minim by a horizontal line connected to a vertical line. Rests were entered by drawing downwards. The details of the implementation are unimportant, but as with the blobs and squares example, this program serves to highlight a more natural way of working.

Buxton compared this with one popular Macintosh composing program where you have to keep going over to a table of notes and then positioning the selected note on the stave. He admits that his system would be slower to start off with, but it would greatly reduce the amount of movement and clicking necessary to write music. Buxton's music notation system was first demonstrated in 1978. Apparently, someone has just introduced a music system which follows similar principles.

Multi-modal input

Imagine a mouse that responded to variable pressure, or a trackball that could react to 'twist' as well as directional movement. You could accelerate your way through a document, vary the width of a brush stroke or control the intensity and duration of a musical note. You could even assign physical properties like inertia to icons so that you'd have to press harder to slide the heavy ones around. Some experimental work has been going on in this area with joysticks that receive feedback from the computer — hit a wall in a maze and the joystick rebounds in your hand.

Buxton does not believe that gestural input is a substitute for all keyboard

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work. He admits that when he was building interactive graphics systems at the University of Toronto, he temporarily became 'a graphics snob'. He used to think that it would be possible to abolish typing. He soon discovered that graphical interfaces are very good at saying some things but disastrous at saying others. He likened this to language, saying: "There's an intimate relationship between the language you use and what can be said."

In studies of users, he found them jumping back and forth between text and graphics, depending on what they were trying to achieve. Broadly speaking, it boils down to spatial coherence versus the use of operands. If you want to select a few different items on the screen, then pointing to them (you, you and you) must be the easiest method. On the other hand, if you want to select all occurrences of the word 'rhubarb' in a document, then it's better to use the keyboard. This may seem terribly obvious, but many programs go for one approach to the exclusion of the other.

As long as improvements in computer design are technology-led, the users are going to be short-changed. It is a fundamental belief at Xerox that only by understanding the user's needs will the right technology be brought into existence. One way in which things could be improved very quickly is by all computer companies swallowing their pride and settling on an input bus standard — rather like the MIDI interface, which has transformed the computerised music industry. Apple has a desktop bus and so does Hewlett-Packard, but these, while a good idea, only perpetuate the serial nature of input and the proprietary nature of each company's offering.

Of course, hardware changes are only part of the story. Software will also have to be rewritten to expect and handle multiple events. It's easy to see why computer manufacturers want to stop revolutionary moves in this industry and make money out of the investments already poured in. With an establishment reluctant to move, this could prove to be a major opportunity for a well-funded start-up operation.

Here's another related Buxton idea: attach a data projector to a Mac, put two mice on — one for you and one for me, load MacPaint and we can have a meeting and share inputs, both textual and graphical, on the screen. The screens may be saved or printed, and this process completely changes the purpose and character of the MacPaint program. This can be done now, as long as you take it in turns to activate your mice.

Buxton can rant on all day about input being the poor cousin of output. He suggests you count the number of makers of video monitors, printers, VGA and EGA boards, then compare them with makers of joysticks, mice and keyboards. He hurls accusations at software writers who come up with powerful programs which don't even provide the basic necessities of real life. An airbrush, for example, is virtually useless without a template or some other form of masking to control the spray — what better use for the left hand while the right is spraying? Drawing boards always have parallel motions (the bar that slides up and down) onto which you can mount set squares. For all their richness, Buxton doesn't know of any CAD program which lets the user do this on-screen. Nor, for that matter, does he know of any with French curves.

Don't get the wrong idea — Buxton is not knocking the advances that computers have brought; it's just that they don't map very well onto what humans find natural.

We, as human beings, are multi-modal. We habitually monitor several things at

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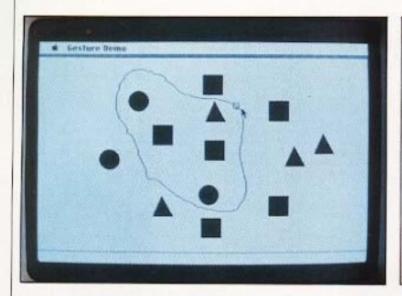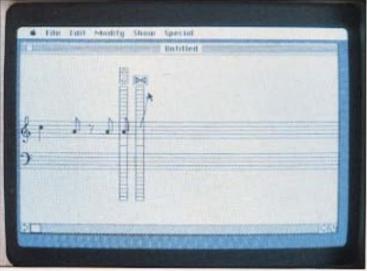
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To move objects efficiently, you should be able to draw around them. A fast way of creating or editing scores is to draw lines and dashes to indicate crotchets and quavers

the same time. We can drive cars while listening for the traffic report to come on the radio, while talking to a passenger, while looking in the rear view mirror, while monitoring the engine noise in preparation for a gear change. If we had a single input channel, like computers, we wouldn't get anywhere. Buxton makes a plea for the computer to be multi-channel too.

He thinks that the PC has an impossible task. He believes that it tries to serve too many masters. Everyone has been led to expect a PC to comprise a keyboard, a screen and, maybe, a mouse. The problem is that different people have differing requirements but, by shoehorning them all into the PC user mould, none of them is served properly. Buxton talks of his microwave as a computer: it has input, the control panel; it has output, heat. It doesn't have a display, nor does it need one. His microwave is a purpose-built computer, one that is designed for the task at hand, no more and no less. Buxton thinks that the first thing we have to do is to start tailoring computers for different purposes. Forcing everyone to adapt to a standard set of interfaces, regardless of the task at hand, is simply too hard and too complicated for the poor old user.

He thinks the future lies in machines aimed at market niches such as CAD and word processing. For economic reasons, he thinks these machines will be bolted together out of smaller components, which carries profound implications for software. He describes his vision as getting away from 'missionary position' computing where one user sits in front of one screen with one keyboard.

Acoustic cues

Buxton also gives a lot of thought to non-speech audio output. This is of special benefit to partially sighted and blind people, but it also helps the normally sighted when too many visual cues are being issued. Research has proved that players of video games perform less well with the sound switched off. As we saw with driving, humans can cope with many inputs. It seems we can cope with more if they're mixed than if they're all of one kind. Yet how many computers and applications make regular use of non-verbal sound?

Buxton demonstrated a simple example of selecting and acting on Mac files on the screen. Move the cursor to a file and you get a reassuring clunk if you score a hit. The clunk varies according to the type of file selected. Move the file and you get another noise to say this has happened successfully. Copy it and the sound of the file being saved will vary according to how much space is left on the disk — less echo for less space. (That would help any user — sighted or not.) Needless to say, a file thrown in the trash can clangs distinctively. Apple has been demonstrating this program, called Sonic Finder, for some time now, but it hasn't yet become commercially available. EuroPARC has just signed up its author.

In your life, I'm sure you have become accustomed to your machine's little noises, especially the disk drives and printer. You almost certainly know from the sound when a disk format has gone wrong, long before the system tells you.

Buxton divides sounds into three categories: alarms and warnings, status

and monitoring indicators, and encoded messages. Alarms and warnings have to take priority over all other information. He describes these as "loud, easily identifiable sounds with sharp transients." The status and monitoring messages depend on what is being monitored. An audible keyclick in one tone and a higher tone when in Caps Lock might be one subtle way of informing a partially-sighted writer of what's going on.

For ongoing continuous tasks, sounds providing status information are usually sustained tones or repeating patterns designed to fade quickly into the background of the operator's consciousness. Buxton says "the human perception system does not remain conscious of steady-state sounds. In contrast, it is very sensitive to change. Hence, if a steady-state sound representing an ongoing background task stops, that transition will bring the fact of a change in state to the user's attention." He cites examples from life such as the change in the note of a car engine or the sound of the washing machine turning off.

Buxton says that humans are capable of monitoring more than one signal in the background, provided the sounds are appropriately differentiated. The problem for humans comes when more than one signal simultaneously requires attention. Our performance drops and we're likely to become confused. He cites the Three Mile Island power plant control room which had over 60 different auditory warnings sounding together. The lesson is clear: while we may simultaneously monitor a number of different audio cues, we can normally only respond to one or two at a time.

Encoded messages are used to

present quantitative data as a pattern of sound. Buxton talks of blind students being able to 'read' the special information of various chemicals by listening to the complex and varying sounds needed to communicate this information. This type of sound and recognition has much in common with musical melodies. Buxton says that "if audio cues are to be used in interactive systems, then the quality of their design is important. As graphic design is to effective icons, so acoustic design is to effective auditory signs, or 'earcons'. To be effective, they require careful design and testing." The spectrum analysis example was first demonstrated in 1980.

Two important sources of knowledge on acoustic design are the psychology of music and a subject known as 'psychoacoustics'. Psychoacoustics concentrates on the relationship between perception and the physical properties of acoustic signals, whereas music is more concerned with higher level sonic structures and our ability to compose and understand them.

Where psychoacoustics tends to specialise in simple sounds, music is concerned with larger structures, including simultaneously sounding auditory streams. This is of great relevance to the use of audio in the human computer interface.
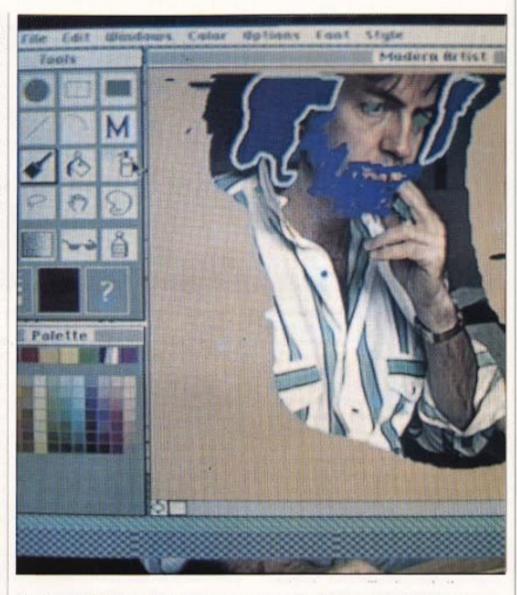
Thanks to MIDI, it is possible to buy a wider range of inexpensive, computer-controlled, sound synthesis and manipulation equipment. Buxton believes that "for the first time, from a logistical perspective, the audio channel has become viable as an important mode of interaction."

As video and computer services converge, real-time images will enhance both serious applications and more creative work

The wired workplace

Part of Buxton's brief is to wire the EuroPARC offices for computer, audio and video services. Fortunately, it's a brand new building and it was built with this in mind. Every room has AppleTalk and Ethernet connections, four video cables and six audio cables. Banks of rack-mounted switching boxes act like a telephone exchange for the video and audio channels.

In the same way that a computer network might have file servers, Buxton's video network has racks filled with videotape recorders. These all run under computer control, enabling anyone to access any part of a tape and have it played back in their office. Never mind 'voice store and forward'; this is the video equivalent.

Buxton sees telecommunications, computing, video, audio, graphics, local area networks and wide area networks all

converging. He is merely building a model today of what he believes will be commonplace tomorrow. He thinks that video is an important form of document because it has the added dimension of time. This is useful at EuroPARC because much of the video work will involve observing people's reactions to new systems. Hesitations can be seen and analysed with videotape in a way that would be impossible by conventional observation methods.

With all these cameras and microphones around, life at EuroPARC may become rather like living in a goldfish bowl. The system is clearly open to abuse and users may not like the idea of anyone being able to monitor their every movement. It smacks rather of 'big brother' and it is the staff's reaction to this that the anthropologists and social scientists will be studying.

The advantages are that staff are able to communicate with each other in the

way they find most natural for the purpose. Sometimes an E-mail letter will do the job, sometimes popping into the next office and, at other times, a video with an accompanying narrative might overcome the need for several members of staff to schedule a meeting together.
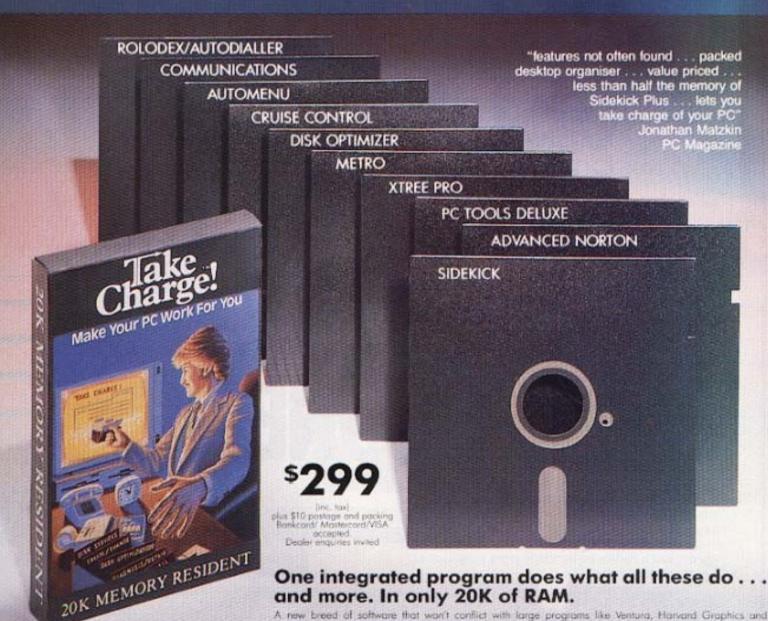
Once the principles are worked out and the systems are proved to work locally, there's no reason why the technology shouldn't span a company, a country or the world. Before letting it out of EuroPARC, though, Buxton believes it's better to study the likely effects within a controlled environment.

In the functions of EuroPARC we have been able to see a small glimpse of the workplace of tomorrow. Yet everything there is based on today's and yesterday's technologies. Anyone who tries to kid users that they're on the leading edge is guilty of almost criminal deception.

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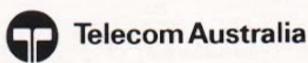
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The next generation

The illustrious rise of the desktop PC now seems to have levelled off: there are no longer obvious mainframe ideas to borrow, but mainframe-style problems prevent further growth. Nick Hampshire believes the solutions to these problems will herald a new and exciting era in personal supercomputers.

The world's first PC was produced in 1975 by a long defunct and almost forgotten US company called Altair. This may come as a surprise, but the PC is still barely 12 years old. It is a technology which has grown up very quickly.

The world's first microprocessor was produced by Intel in 1971 — it was the 4-bit 4004. This was a very hard chip to use because of its small and awkward instruction set. Within 18 months, Intel had launched a far easier chip: the 8-bit 8008. Neither the 4004 nor the 8008 were designed as single-chip computers; in fact, they were designed to act as simple programmable process controllers. When people started to build small computers using these chips, it was as much of a surprise to Intel as it was to the computer industry at large.

The potential of these chips was quickly recognised by many amateur computer enthusiasts, who saw a cheap way of making the computer they had long wished to own but could never afford. It did not matter that the resulting system had an inefficient design, or that it had an unwieldy instruction set and a total lack of system software and high-level languages. What was important was that it offered them computing at an affordable price.

Early versions

These first computers were simple. They were programmed by toggle switches on the address and data lines. The output was to a row of LEDs or, if the user was lucky, an ASR33 teletype with a paper tape punch and reader. It was little wonder that they were dismissed by the computer companies as mere toys.

Machines like the Altair soon gave way to more sophisticated products like the Apple II and the Commodore Pet. However, all these early systems had severe limitations imposed upon the designers by the level of available electronics and by the lack of certain technologies.
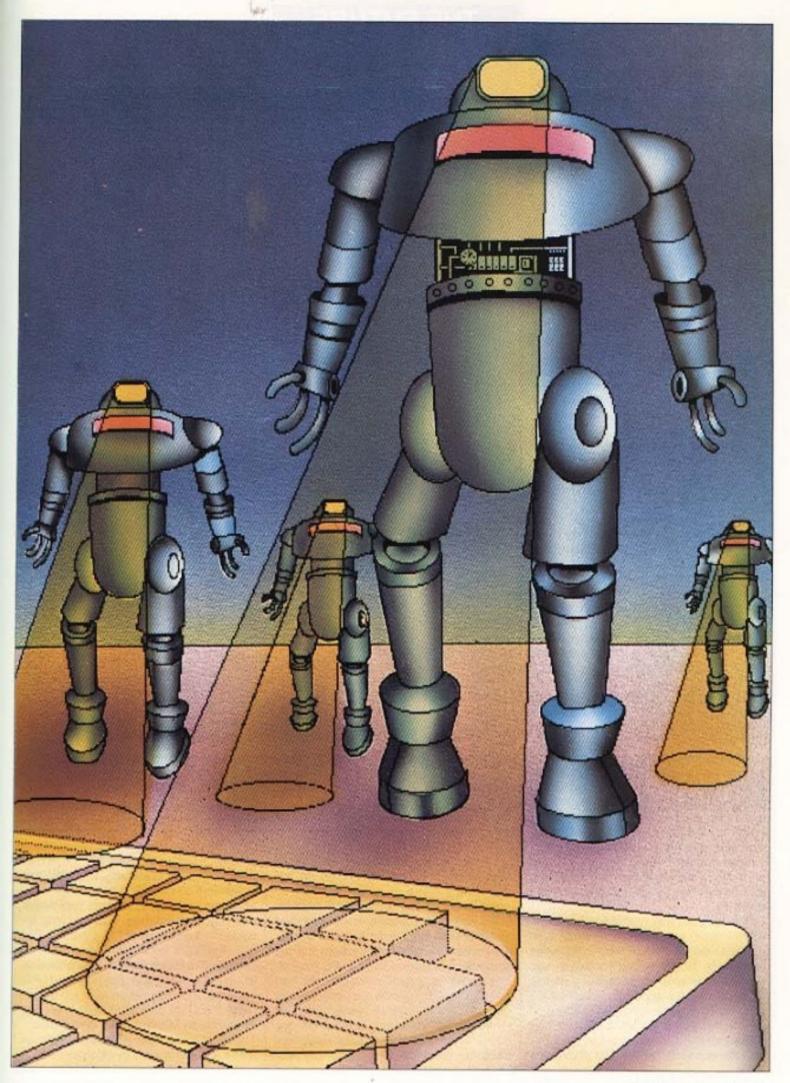
The integrated circuits produced to support these first-generation microprocessors had similar limitations. They were fine for supporting a hexadecimal keypad or a simple hex LED display. But there were no special-purpose video chips, and even the early versions of the serial I/O chips were flawed and therefore unsuitable for standard RS232 communications to a conventional terminal.

Video displays were added, but they had to be built using many small integrated circuits. This added to the cost of the system and it was hardly surprising that most of these displays had limited capabilities.

Once the semiconductor companies realised in the late 1970s that the demand for personal computers existed, they started to cater for its needs. Simple video chips were produced, as were serial communications chips and disk controller chips. Markets were also created for new products like small disk drives and cheap printers. This mushrooming of new products to cater for a growing PC market was a major turning point for both the personal computer and the semiconductor industries, and had major implications for the computer industry as a whole.

By 1979 the needs of the personal computer market had become a major force behind innovation in the semiconductor industry. In their drive for competitive advantage and market share, the PC manufacturers wanted more memory, better support electronics and,

above all, faster processors. By then the PC manufacturers were among the largest consumers of integrated circuits, memory chips and microprocessors and no semiconductor company could afford to ignore their needs.

The 8086 tempts IBM

In April 1979, Intel launched the 16-bit 8086, the first microprocessor specifically designed as a computer chip. The 8086 was a microprocessor on which both software and hardware companies could develop serious products. It featured a considerably improved instruction set, better instruction timing, improved arithmetical operations, better memory management, and a much larger addressable memory space.

The instruction set was far closer to that found on existing minicomputer systems and this encouraged software companies to produce the necessary programming tools for the 8086. Among these was an operating system called QDOS from Seattle Computer Products, later acquired by Microsoft to become MS-DOS, the operating system for the IBM PC.

Another reason for the success of the 8086 was that Intel designed a family of related chips. These included graphics chips and disk controllers as well as the conventional I/O chips.

Another member of this family was a new type of chip altogether — the coprocessor. Initially, it was just used to extend the arithmetical capabilities of the processor; later the concept was also used to provide extended graphics capabilities.

The availability of this microprocessor encouraged several companies to enter the PC market; pre-eminent among them was IBM, whose entry brought on an explosive growth in the availability of software products. The IBM name inspired confidence, a confidence which was sufficient to encourage corporate buyers to purchase PCs and to inspire software companies to invest considerable sums in developing good commercial software. This establishment of an industry-standard design marked the second turning point in the development of the PC.

This standard was not technically exciting — there were far more innovative products on the market from companies like Apple. However, the hardware was solid and reliable — perfectly suited to running business applications software.

For most of us who had been involved in the industry from its birth and had helped create it, this was a sad time. For with the imposition of the IBM standard a
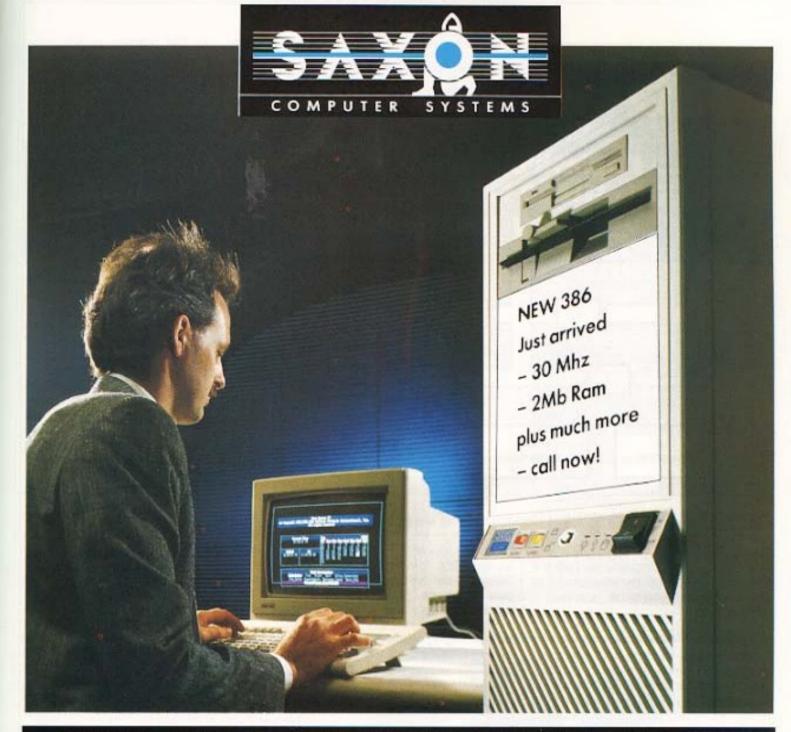
Fig 1 How the cache fits into memory management

great deal of the innovation, excitement and entrepreneurial activity within the market was stifled.

However, at the same time another trend was quietly arising which rekindled much of that early optimism and excitement; the flow of expertise from the big computer companies into the PC market. The most important development had been IBM's influence on Intel in the design of subsequent generations of microprocessor chips based on the 8086. Professional computer designers became involved in microprocessor

design, resulting in chips like the 80386 which compare favourably with mini and mainframe computers.

Computer professionals from the mainframe companies also became involved in the design of PC software. IBM is a significant force in this area and has combined with companies like Microsoft to create new generations of PC software, the culmination of which is currently the OS/2 operating system with its Presentation Manager user environment. These products are the first stage of IBM's long-term plan to incorporate PCs

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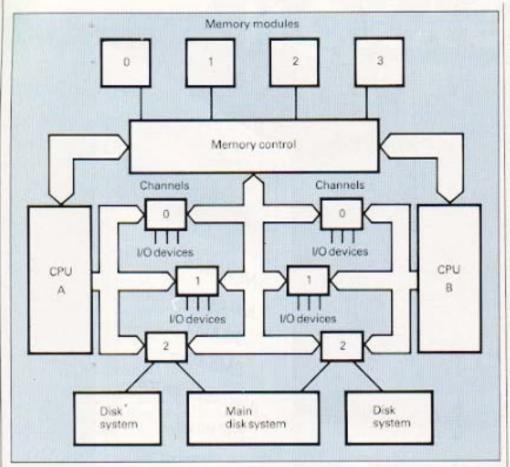
Fig 2 The configuration of a large IBM system containing two CPUs

into mainstream computing so that any piece of software will run equally well on a PC or big IBM mainframe.

New architecture

Designing an 8-bit computer system was easy: it was simply a matter of connecting a dozen or so ICs. The same was true of the early 16-bit systems using the 8086. However, one cannot design a '386-based computer on the back of an envelope, particularly one operating at 25MHz. With increased speed, PC designers are now having to overcome the same problems that faced mainframe designers in earlier days.

Since a computer's power is roughly assessed as the speed with which it can execute instructions, it is possible to increase the power of a computer by increasing the speed of the controlling clock. But increased clock speed brings with it a range of problems — the biggest of which is the 'Von Neumann bottleneck'.

This bottleneck occurs because a processor's maximum speed is always limited by the amount of time it takes to access data and instructions from memory. An enormous amount of ingenuity and effort has gone into ways of

overcoming the Von Neumann bottleneck in the design of mainframe computer systems. Mainframe designers have never had fast enough memory, since processors have always been faster. The opposite has been true in microprocessor development. The semiconductor memory chip was an established technology when the first microprocessors were created, and because they use the same technology, processor speed and memory speed have, until recently, tended to keep pace with each other.

Now, the situation has changed. Processors like the 80386 can operate at 25MHz, a figure which Intel should be able to double using existing technology and which could be doubled again using new semiconductor technologies such as Bi-CMOS. But these clock speeds are outpacing improvements in memory access time, so PC designers are now facing the old problem.

Any solution to the Von Neumann bottleneck has to involve either speeding up the access time or reducing the number of memory accesses. One simple way of speeding up the access time is to use higher speed memory technology. Static RAM chips are faster than dynamic RAM chips, and TTL or ECL memories are

faster still. The problem is that faster chips usually have lower memory capacities, higher prices and higher power consumption.

Lower capacity means that more chips are required and the increased distance between the memory chip and the processor will result in a loss of some of the speed advantage. And higher power consumption requires bigger power supplies and extensive cooling facilities to dissipate the power.

The other alternative is to reduce the number of memory accesses. This can be done either by making the instruction set more powerful or by fetching larger chunks of data during each access. For example, a multiple instruction eliminates the need for dozens of memory or register accesses and is therefore much faster. Similarly, accessing 32 bits of data at a time is far faster than making four accesses of eight bits.

Designers have used both techniques for improving processor power. Unfortunately, bigger instruction sets and wider data paths require bigger silicon chips, and the limits of manufacturing technology are already stretched with chips the size of the 80386.

Another way of speeding up memory access is to use the time during each instruction cycle more constructively by accessing the next memory location while the processor is still executing an instruction, rather than repeating a cyclical process in which memory accesses can only take place during half the instruction cycle.

This technique is called pipelining — it means that data access time can be almost as long as a processor execution cycle. However, at most it will only double the execution rate. Nevertheless, pipelining has been employed in the design of most of the big microprocessor chips like the 80386.

Using faster memory may not be a cost-effective solution. However, there is no need to use high-speed memory for the entire system. Most memory accesses are, at any one period within the execution of a program, confined to a relatively small area of memory. Simply putting a number of general-purpose registers on the processor chip will result in a marked speed improvement.
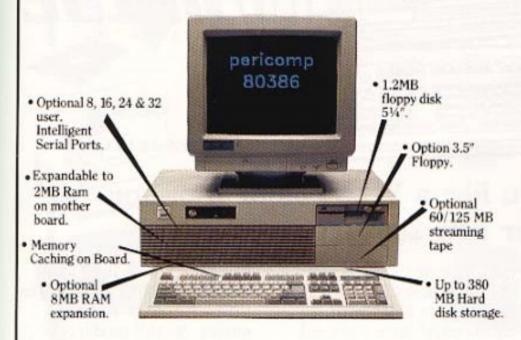
This approach can be further extended by having a small area, say 64k out of a total of 2Mbytes, of very high-speed memory. This area is known as a 'cache'. In most programs about 80 per cent of memory accesses can be located in this cache area.

Cache memory is found on virtually every large computer system, and top-end microprocessor systems are also

Page 132 APC 100th Issue

starting to use it. The Inmos Transputer, which is a high-speed super micro, gains much of its speed by having several kilobytes of very fast cache memory actually located on the processor chip.

IBM has used a 64k cache memory in its 25MHz 80386-based Model 70-A21 PC. This is a feature which we will see much more of in future microprocessor-based systems.

Cache memory will only give speed improvements if it is properly and efficiently utilised, which can be achieved by employing special hardware to control the contents of the cache. Any time a word in memory is accessed, it is automatically moved to the cache together with the contents of its immediate neighbours.

The cache controller stores these memory blocks with their addresses so that it can access them associatively. The processor accesses the cache controller first to see if the required location is stored in the cache; if not, then normal memory access procedures are employed.

Virtual memory

The use of cache memory is a natural part of a hierarchy of memory management. Main memory can be used as a cache for programs and data stored on disk. The use of disk to store parts of a program not currently being used is referred to as virtual memory. Its advantage is that it allows programmers to write programs far larger than the amount of available RAM memory.

Just like cache memory, virtual memory needs special hardware to implement it efficiently. This circuitry works by loading only those sections of a program or data into memory that are currently needed. All unused segments are cleared out of RAM and placed on disk. The hierarchy of memory from disk to processor register in a virtual memory machine is shown in Fig 1.

Virtual memory systems have many advantages. If the programmer or the program knows that the amount of memory available is almost unlimited, then all constraints on program size are removed, large databases can be seemingly stored in RAM, and programs can become as large as the programmer wishes. But the greatest advantage of virtual memory is that it allows programs and data to be portable between one machine and another, even when they have different memory configurations.

Virtual memory has been employed on large computer systems for many years, but has only recently reached microprocessor-based computers. Processors
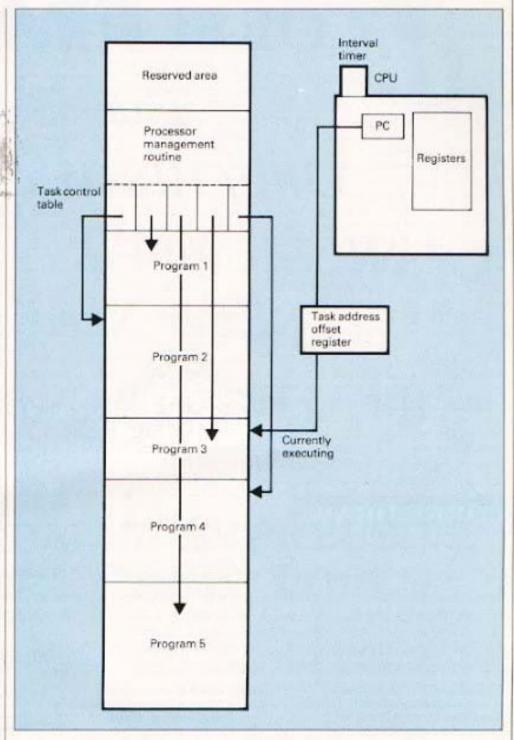
Fig 3 Multi-tasking: Program 3 is currently executing

like the 80386 and 68020 have memory-management circuitry which can efficiently organise and manage a virtual memory system. This is another feature of mainframe systems which has now been successfully transferred to PCs. The adoption of so many mainframe design techniques in the latest generation of microprocessors and microprocessor-based computer systems indicates the level to which the technology has progressed. It also suggests that we are beginning to see signs of impending limitations to the further growth of PC computing power.

The Von Neumann bottleneck will not go away — memory will get faster, but never fast enough. The concept of cache memory will only provide temporary alleviation of the problem. It may not be worth producing a 50MHz processor which spends a lot of its time waiting for memory; putting memory on the processor chip would help, but even here there is a limitation imposed by chip size and the laws of physics.

Nor is there much scope left for increasing the size of data paths. Increasing it from 32 to 64 bits will only double the power (and at the same time double

the component overhead in providing wide data buses). In fact, 32-bit is probably the largest practical data size on a PC.

At the other end of the spectrum there is still considerable room for improving the access speed of bulk storage devices. Hard disks are getting faster and larger all the time. A 600Mbyte PC-style Winchester hard disk with 20ms access time is already possible, and the technical limits are still a long way off. We have yet to see systems using large high-speed solid-state disk drives. According to predictions by some semiconductor manufacturers, this looks set to be one of the main markets for the 16Mbit DRAM when it becomes available in two to three years time.

With such impending limitations on the further increase in the power of desktop computers, where does this leave the user with his unquenchable thirst for more computing power at lower cost? Here are two answers — multi-processing and distributed processing. Both techniques have already been effectively used for increasing processing power in both the mainframe and minicomputer worlds.

In a multi-processor system a PC would contain several processors, each

probably equivalent to an 80386 at 25MHz with a couple of megabytes of RAM. The whole lot would be supervised and would communicate with each other and the user via a control processor. A program running in such a machine would be logically divided so that all the processors would work on separate parts of it concurrently. The processing power of such a machine would thus be roughly equivalent to the number of processors used. With a multiprocessor, it is possible to build a computer of any power — desktop supercomputers such as the Meiko Computing Surface have already been built. For those users who crave more and more computing power this is the logical choice of machine type.

The solution in most commercial environments is distributed processing and computer resource sharing across several machines, involving the linking of several moderately powerful PCs, perhaps with a mini or even a mainframe computer, in a network. This network can be confined to a single locality, several widely spaced localities, or even spaced around the globe. Not only can networked systems provide computer resource sharing, they can also form the basis of those other mainstays of

modern business — data communications and electronic information storage and retrieval.

PS/2: the mainframe micro

Designing a computer which can meet the continually growing needs for computer power is no simple task. It is complicated by the existence of two separate routes towards greater power. One could build a straightforward multi-processor system or concentrate on a much simpler network-orientated system. The problem is that a PC is a mass-produced product: it needs to be a general-purpose computer which can be made economically and sold at the lowest possible price.

This is a problem which IBM has attempted to overcome with the design of the PS/2, which enables it to be a fairly conventional machine like a standard AT or a small but potentially very powerful multi-processor system.

In fact, IBM has tried to do many different things with this machine. Besides allowing it to be configured as a powerful multi-processor as well as a simple network system processor, steps have been taken to speed up the system still further

It's a Gift!

by eliminating the delay inherent in input and output operations.

This I/O delay is a serious limitation to processor efficiency, and probably contributes as much to slowing down a system as any other single factor. In a PC, the two speed-critical I/O devices are the disk drives and the video screen. Other devices such as the keyboard and mouse, which rely on user input, can never have a response time which is faster than the user.

With disk drives, the main delay is due to the mechanical movement of the head. When the head is positioned over the right track, data transfer can be rapid. The delay caused by the video screen is simply due to the enormous amount of processing needed to change or update it.

The simplest answer to these problems might be to speed up the I/O devices, but this is easier said than done. A better idea, which is employed on most mainframes, is to remove the I/O function from the processor. A special I/O processor for a device like a disk drive can handle the I/O while the main processor is doing something else.

This is, of course, an extension of the concept of using a coprocessor except that it is no longer a slave processor. It can assume full control over both the system bus and memory. IBM calls these intelligent I/O processes 'channels', and has brought them from the mainframe to the PS/2 series of machines.

On the PS/2 this is called the 'Micro Channel' and should not be confused with the bus found on a conventional PC. A conventional bus lets the processor access memory and memory-mapped I/O devices; it is not designed to allow other devices to gain control of the bus lines. With two processors trying to control a conventional bus, the inevitable result is a bus deadlock and a system crash. (It is possible to avoid a bus deadlock but that would require a lot of extra circuitry.) The PS/2, however, uses bus arbitration to allow several competing devices to share the bus lines; it can not only support intelligent peripheral devices, but also multiple processors.

Micro Channel Architecture (MCA) is, therefore, a major step forward in PC design. As well as eliminating I/O delays and allowing the use of intelligent I/O hardware, MCA enhances data integrity within the system because I/O is always a potential source of system corruption. Having any I/O port directly mapped into memory space makes the whole system vulnerable to corruption. The use of the Micro Channel with intelligent I/O con-

trollers overcomes this by allowing all error checking to be done in the channel rather than in the processor memory area.

The Micro Channel is also a useful way of very quickly moving large blocks of data between memory and an I/O device such as a disk drive or video display. In fact, the IBM PS/2 design can move data at up to 20 million characters per second. Data transfer of this sort does not require any processor overhead.

Of course, the benefits of MCA and concurrency are dependent on the software run on the system, hence the importance of the OS/2 operating system.

It is interesting to see how the design of a PS/2 series machine is beginning to show a remarkable similarity to the design of a large IBM system. Fig 2

> 'The limitations facing PC designers are the same as those that faced mainframe designers 10 years ago.'

shows the block diagram of a twin-processor IBM mainframe; it is not unlike a PS/2 machine with a second processor.

SAA and networking

The convergence in the architecture of mainframes, minis and PCs is not entirely accidental. Most large computer companies have now instituted projects aimed at bringing together all sizes of computers into a common architecture. The idea is that a user can smoothly progress upwards in size of machine without having to throw away the investment in applications software. It should also allow users to integrate different sized machines easily into networks.

Of most significance to PC users is the IBM project to unify its system architecture. This is called SAA (Systems Application Architecture) and will provide a consistency across three major IBM computing environments: the System/370, System/3x and the Personal System/2. This philosophy of common design has four key components — common user access, common programming interface, common communications support and, last but most importantly, common applications.

SAA is not a product; it is simply a set

of design protocols and philosophies. These can be used to implement a multi-processor network architecture which encompasses a range of different-sized machines. The SAA philosophy is being used both on the levels of hardware and software. SAA will only be practical when both can come together.

Although SAA has only recently come into the news, it is a project on which IBM has been working for several years. Many of the components are already in place — for example, the design of the 80286 and, in particular, the 80386 were influenced by the needs of SAA. This was part of the flow of expertise from IBM to Intel as a result of the establishment of joint IBM/Intel engineering design groups.

The new microprocessors were essential in order to make the PC component of SAA work. What was required was a very fast, powerful processor capable of accessing large amounts of memory and performing robust multi-tasking applications. All these facilities have been provided in the '286 and '386.

Multi-tasking is an important element of the SAA philosophy, being an essential element of any robust network. A PC connected to a network must be capable of using that network independently from any applications program. This is already the case in all PC network systems, but they have two serious drawbacks which have prevented PC networks being used in 'mission critical' applications.

The first limitation is the ease with which unauthorised users can access PCs on a network; passwords are no real protection against the determined hacker. Secondly, any corruption of incoming data can lead to a software interference between this corrupted data and the application program currently being run.

The weakness in both cases is that the application program and the network software lie in the same memory area, control being switched using interrupts. This problem can be overcome with a multi-tasking environment where the processor architecture is designed so that different applications lie in different blocks of memory.

There is then a hardware 'wall' between different processes running on one machine. Such a wall is provided by the protected memory mode of the '286 and '386 processors (see Fig 3).

In a 'protected mode' multi-tasking system, the user could have one or more tasks running and so could the network. Each task would be allocated a small block of processor time, with tasks executed in order of priority. With a power-

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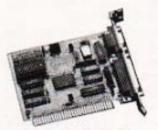
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X18005 (2 Drives)...**$52**

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- Hercules compatible
- Interface to TTL monochrome monitor
- One Centronics parallel printer port
- 2K-Static RAM, 64K Dynamic RAM
- Display Mode: 720 dots x 348 lines

Cat. X18003 ..... **$139**

COLOUR GRAPHICS CARD

This card plugs staight into I/O slot and gives RGB or composite video in monochrome to a monitor.
Colour graphics: 320 dots x 200 lines.
Mono graphics: 640 dots x 200 lines.

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- Standards: 320 x 200, 640 x 200, 640 x 348, and 720 x 348.

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This card features a parallel interface for Centronics printers. Included is printer data port, printer control port, and printer status port.

Cat. X18017 ..... **$29**

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Cat. X18019 ..... **$29**

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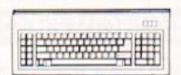
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ful processor, the division of time between tasks will be unnoticeable to the user. In essence, a protected mode multi-tasking machine will behave as if it is two or more separate machines communicating with each other via a cable link.

A protected mode multi-tasking computer is not unlike a small network in its behaviour. Each process behaves like an independent machine and the communications pipes between each are, in software terms, exactly the same as the cable links in a network. This similarity is very important since it is the key to the creation of distributed processing systems.

When such a machine is attached to a network, other networked machines will look like additional processes. This means that the network becomes an extension of each machine and not just a means of moving data from machine to machine. There is no reason why the user of one machine should not be able to run a program in another machine. The performance of the second machine would not suffer any degradation, and it would appear to the user of the first machine that the program was running on his or her own hardware.

This type of network can start to look very much like a parallel processing system, potentially with enormous power. If the network includes a mainframe or large mini, then each user also has the potential power of that machine to boost the power of his PC. In its current version, OS/2 cannot support this type of system. However, it will almost certainly be included in later versions. Currently there is only one operating system I am aware of that supports resource sharing and that is QNX, which is a Unix derivative.

Applications

The similarity between multi-tasking processes and networks has allowed designers to improve the way in which databases are utilised. In a traditional PC network, one machine is dedicated as a file server and has attached to it a large disk drive for data storage. When a user attached to the network wants to import data, he accesses the file server and transfers a copy of the required file to his own machine. He uses and updates the file on his own computer and then returns it to the file server, which replaces the existing copy.

The use of such traditional networked databases is fraught with danger. Corruption can occur as a file is transferred from the file server to the user and back again. The user could be unauthorised

or make erroneous amendments. It is also a slow process to transfer a very large file across a network.

The solution is for the user to send the file server a specification of what is required or what is to be amended or added. The file server, rather than the user, will then update the file. The file would no longer be accessible and the file server appears to the user to be a concurrent process. This technique is known as SQL or Structured Query Language and should provide the kind of data integrity which is essential for mission-critical applications.

Because SQL puts the burden of file maintenance and query onto the file server, in a large network it will be expected to perform a lot of processing. This will require a fast, powerful processor with a lot of disk storage, and it will therefore probably be either a mini or mainframe computer. This trend is one of the driving forces behind SAA and points to a future where the function of big machines could well be confined to acting as file servers to PC networks.

The creation of such multi-tasking machines does, however, carry several penalties. A fast processor is required: a 20MHz clock is probably the minimum which will allow half a dozen tasks to be run without any perceptible degradation of system performance. It also needs a lot of memory — if each task is running in what appears to be a single PC then it could need the 640k of memory found in such a machine. Three or four such tasks will soon utilise 2Mbytes of RAM — indeed, four or 6Mbytes is probably a more practical minimum memory size. With the availability of larger memories, software houses will be encouraged to produce bigger programs, therefore bigger disk drives will also be necessary; here, 100Mbytes would probably be the minimum.

The need for large amounts of memory and the existence of large disk drives means that virtual memory would be a very important component of such systems. It is crucial to the concept of SAA, for without virtual memory it becomes difficult to transfer programs between different machines. In a virtual memory system, all addressing is relative to an offset value which is maintained by the virtual memory control hardware. Changing systems is simply a matter of changing offset pointers.

Another important hardware feature which aids code portability is the use of intelligent I/O. In such systems, programs communicate via device drivers rather than by I/O ports at set memory locations. This concept of divorcing the

program from the hardware began with the design of Micro Channel Architecture and has continued with the design of operating systems like OS/2.

All this points to the idea that the PC which conforms to the SAA philosophy will be big and very powerful. The operating system will also have to be large and complex in order to handle the multi-tasking environment as well as the hardware independence which is crucial to the SAA concept.

Again, this will reinforce the need for a powerful processor with lots of memory. It will also need very robust user interfaces which will make this complex system easy to use with minimal computer expertise.

Conclusion

In 12 years the personal computer has grown from little more than a pocket calculator to a machine which can seriously challenge the existing status quo in the computer industry. There is no doubt that an 80386 PC has as much processing power as the average mainframe of 15 years ago. All that power for one user — and still more is demanded.

It seems to be a general rule in computing that applications will develop which utilise the full power of a machine and then need 10 per cent more for those extra features.

Until now, the skill of the semiconductor industry has managed to supply this continuing thirst for more powerful personal computers. But the technology is being stretched to its limits and we can no longer expect such rapid development.

The limitations facing PC designers are the same as those which faced mainframe designers 10 years ago. The solutions are also the same; in fact, the difference between the single processor mainframe and the single processor PC have become minimal. They are now only really separated by differences in semiconductor technologies.

This convergence is leading the computer industry into new and uncharted waters. Desktop supercomputers and large networks of very powerful PCs will dominate, being capable of working singly or as a massive, parallel, collective super-processor. The characteristics and capabilities of these systems are still largely unknown.

No longer can the PC developers rely on copying mainframe developments — everyone is now at the leading edge of computing. I find this situation exciting and stimulating: the fun has returned to computing.

The Personal Computer in the year 2000

Alan Kay has had a profound influence on the microcomputer user interface. Mice, icons, windows and the Smalltalk programming language can all be attributed to the team he led at Xerox PARC in the 1970s. Now he, and a number of fellow researchers, have contributed to a panel of experts charged with the task of predicting the form of the personal computer in the year 2000.

Certain themes ran through many of the contributions — an intuitive, customisable user interface, speech and handwriting recognition, and seamless local and wide area communications.
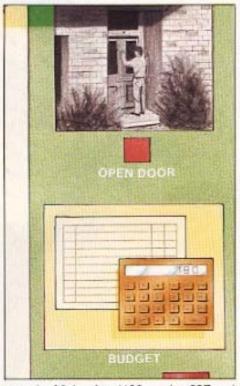
On the following pages you will find the specifications for their Personal Computer of the Year 2000 — 'The Worksheet'. The Worksheet is envisaged as not one, but three products, all similar in functionality, but differing in size and speed. The main machine will be A3 in size, and will fold in half to form a portable package about the same size as a copy of *APC* but about 50 per cent thicker. There will also be an A4 version of The Worksheet, which will not have a keyboard — just one big screen. Finally, there will be the Pocket Worksheet, about the size of a pocket diary, which will function as diary, communications device and notebook.

If, having read through this article, you feel that The Worksheet is too far-fetched, you should be aware that nearly all the technologies described are currently available. Some are still at prototype stage, others are in production but at a very early stage in their evolution. Anyway, experience has shown that technology advances faster than we ever imagine.

We would be interested in hearing your views of The Worksheet.

Hardware

The basic hardware of the Worksheet A3 has been designed to fit both the casing design and marketing requirements. The

case is A3 in size (420mm by 297mm) and about 30 to 40mm deep. Internally it will use two separate circuit designs printed inside the halves of the A3 case and linked by a multi-way flexible ribbon cable across the hinge. The division of functions between the two boards is carefully chosen so that the A4 version can be created simply from just one of these two circuit designs.

As a result of this design, the central processor and the essential coprocessors will be sited on one side, with half the A3's 32Mbytes of RAM, while the other side has the second 16Mbytes of RAM and the optional coprocessors that make up the more powerful A3 machine.

The display circuitry will be mounted directly onto the back of the flexible LCD screen, and in the A3 this comprises an array of 48 dedicated video tile processors, each with 1Mbyte of RAM on-chip and each linked to the next via a fast local parallel bus.

Communication between the main circuitry and the video array will be handled by a tile channel multi-plexer chip, close-coupled to the central processor and coprocessors over the main system bus. This chip transfers graphic objects sent to it to the row-end tile processors, which then take over the task of displaying it.

The other essential coprocessors are the ISDN handler, which will drive an optical port and give access to both a local external device bus and wide-area ISDN networks; the 160-bit floating-point coprocessor; and the interactive string processor. These are managed by the operating system which is stored in 4Mbytes of 64-bit ROM on the main circuit. The operating system can dynamically configure the coprocessor architecture to suit the application, bringing the processors to 'life' and 'killing' them to save battery power when they are not in use.

All the coprocessors communicate with each other and the operating system via 'black box' objects, parcels of instructions and data broadcast over the local system bus.

The external interfaces on the A3 comprise the local and wide-area ISDN ports, the local port also handling peripheral devices such as printers, two 500Mbyte 'smart card' slots, and a single coprocessor bus slot for third-party application-specific processor chips. All these are placed on the main board which is common to both the A3 and A4 versions of The Worksheet.

On the second circuit in the A3 is the second 16Mbytes of RAM, and — obviously — the second 24 tile processors for the second half of the screen. Also on this circuit is the data compression/encryption coprocessor, the speech analogue/digital processor, and the video overlay processor. These offer secure communications and more efficient storage, with compression and encryption in real time; speech recognition and output, either directly or via the

ISDN interfaces for voice messaging; and time-lapse video overlay for the screen to handle video telephone or CCTV monitoring features.

To reduce memory requirements, the video scan rate is not real-time, but is adjustable to suit the application: one frame per second for time critical applications down to one frame each 100 seconds for security monitoring, for example. The video image is just another object to the tile processors, and can be repositioned on the display at will.

The Worksheet will be a 'soft' machine, and so there will be just an on-switch which first starts the machine by connecting its A4-size thin-film battery to the main circuit. After that, powering-down is a software function although there is a secure reset button that can only be activated by the machine's own coded stylus. The battery will give 12 hours continuous operation, with Hyper-Recharge$^{(TM)}$ technology which can recharge it fully in 10 minutes from any form of power source.
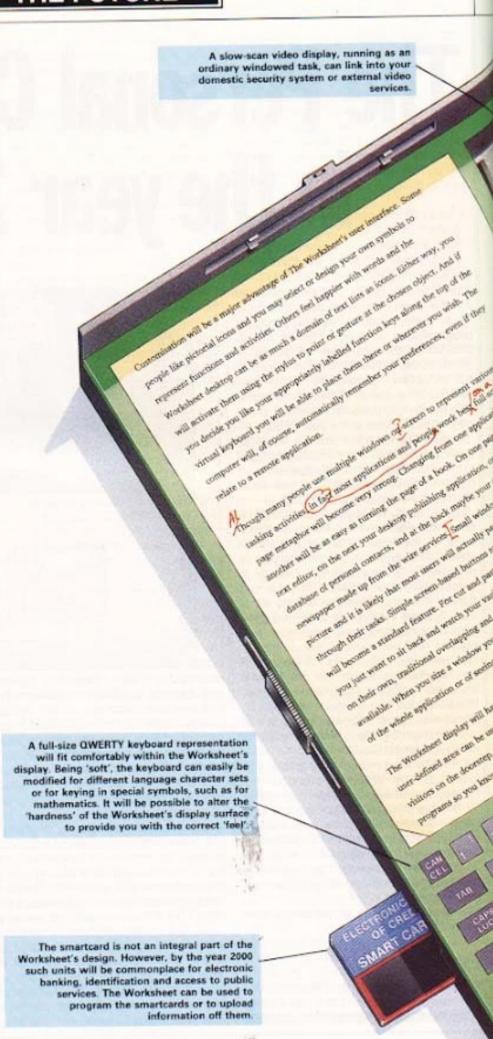
The goal of the Worksheet design is simplicity and modularity, making it easy and cheap to build without compromising performance and shifting the price balance so that hardware is cheap and software is — relatively — expensive. The circuit printed on the case is largely just one fast bus linking memory, central processor and coprocessor together for object flow. The well-defined local ISDN interface makes peripherals easy to design and handle, and the dynamic hardware configuration of the operating system automatically takes advantage of any peripherals or specific coprocessors available without user intervention.
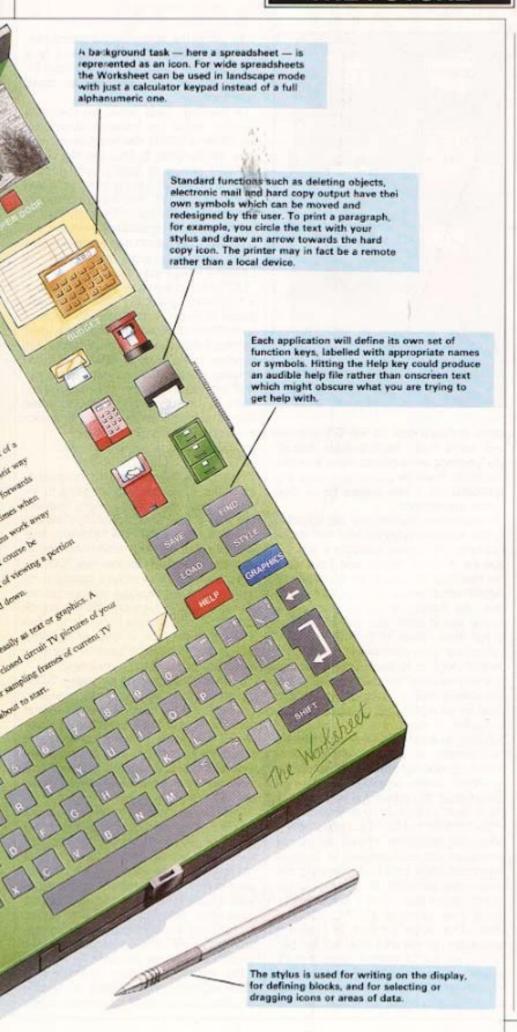
The hardware will be transparent; users will only need to pick up their styluses and work.

The screen

The Worksheet screen will appear to be the computer. It will be the only input and output device for the majority of the applications which will run on the machine.

The screen will be made up of many interconnected graphics processors which are mounted directly on to the back of the flexible screen material. Each processor will control a 512 by 512 square of pixels and will use 1Mbyte of RAM to store the screen data. This will allow 32 bits of information to describe each screen pixel. The first 24 bits of this information will be used to describe the 16.7 million colours available at any one time. The last eight bits will be used for a number of purposes. They will hold the data used for encrustation of video signals, for screen depth information, for

A slow-scan video display, running as an ordinary windowed task, can link into your domestic security system or external video services.

A full-size QWERTY keyboard representation will fit comfortably within the Worksheet's display. Being 'soft', the keyboard can easily be modified for different language character sets or for keying in special symbols, such as for mathematics. It will be possible to alter the 'hardness' of the Worksheet's display surface to provide you with the correct 'feel'.

The smartcard is not an integral part of the Worksheet's design. However, by the year 2000 such units will be commonplace for electronic banking, identification and access to public services. The Worksheet can be used to program the smartcards or to upload information off them.

A background task — here a spreadsheet — is represented as an icon. For wide spreadsheets the Worksheet can be used in landscape mode with just a calculator keypad instead of a full alphanumeric one.

Standard functions such as deleting objects, electronic mail and hard copy output have their own symbols which can be moved and redesigned by the user. To print a paragraph, for example, you circle the text with your stylus and draw an arrow towards the hard copy icon. The printer may in fact be a remote rather than a local device.

Each application will define its own set of function keys, labelled with appropriate names or symbols. Hitting the Help key could produce an audible help file rather than onscreen text which might obscure what you are trying to get help with.

The stylus is used for writing on the display, for defining blocks, and for selecting or dragging icons or areas of data.

the touch status and for the touch pressure.

The touch status will tell the system which areas of the screen are currently being depressed and how much pressure is being used. By fast communication between the processors, the screen will not only tell the system which areas are active, but how fast the touch or stroke was, crucial in recognising the user's signature as accurately as possible.

The screen on the A3 version will be 4096 by 3072 pixels. The whole screen will be controlled by 48 processors and will have a total active memory of 48Mbytes. The links between the processors will be parallel and hard-wired, with an independent 'data thru' controller that will allow communication between processors without slowing the intermediary ones down. The chips will use a small, specialised RISC instruction set. This will allow a very high clock speed to be used.

The screen itself will be flexible and pliant. It emits pure white light across its total surface and uses LCD colour filters to interact and diffuse the light into the 16.7 million combinations. The back lighting will be provided by the latest Light Emitting Liquid Crystal technology. This is a high-brightness, low-power technology, developed initially in the F24 fighter head-up display.

The touch sensitivity is provided by a triple coating over the display. The screen will have the ability to mimic the feel of many substances. For example, a screen keyboard will be able to mimic the IBM click, the Spectrum squidge or any other you can name. This is possible because the middle layer is an electro-rheological dilatant material. A dilatant material is one which goes hard when a force is applied. This will give a touch whose hardness can be modified electro-rheologically (by an electrical current). The other two coatings will be the pressure/touch sensor and a special long life cover film.

The screen will be produced in huge sheets which, once tested, are cut down to the A3, A4 or pocket book size. In fact, the screen production technology was initially developed for producing 360 degree cinemas in the late 1990's.

The screen architecture is scalable, in that once you've told the operating system how many tiles are present it sets up the necessary data links. The screen then operates all the graphic functions itself. The only data interchange between the processor and the screen is in the form of graphic objects.

At present, materials researchers are close to a breakthrough in the field of
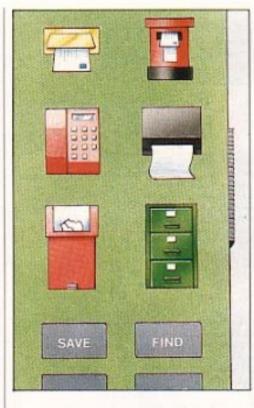
matrix printing and input. This would allow a coated screen to be used as a scanner and printer. Simply lay the image you want to capture on the screen and it is captured. Or lay a blank page over the image on the screen you want to produce a print of, and the image is transferred to paper. The main stumbling block at present is producing a paper which is already impregnated with the correct ink levels, so all the screen has to do is 'burn' the colour information in. It will probably be 2010 before this technology becomes cheap enough for large scale production.

Operating system

The operating system of The Worksheet will be large, multi-tasking and above all, modular. By the year 2000 the increasing lag between hardware advances and the applications software to exploit them will have rammed home the importance of reusable software. Most of the functions needed in a personal computer will be built into the operating system, reducing applications to little more than a sequence of OS calls with a user interface.

The Worksheet's operating system, OS/2000, will consist of a core of system modules like the Memory Manager, Scheduler, Message Despatcher and Communications Controller together with a number of service 'engines' each performing a particular type of generic task. There will be a Calculating engine for floating-point maths, an Editing engine, a Dialogue engine to support user interfaces, a Typography engine, a Drawing engine, a Searching engine, a Sorting engine, a Filing engine and so on. In many cases these engines will be driving an underlying hardware coprocessor (such as a floating-point chip, a string processor, or a data compression processor). The functionality of the operating system will not depend on any specific coprocessors being available. However, if a suitable coprocessor is fitted to the machine, the operating system will use this in preference to its own software routines. All this will be transparent not just to the user, but to the application as well.

OS/2000 will use a 'software bus' to string these engines together in different configurations to solve specific problems. The design of this software bus will be the most crucial part of the operating system and its shape can only be vaguely glimpsed today; it will be an object-orientated system in which the engines appear as 'black boxes' joined by channels along which they exchange encapsulated objects and messages. Application programs will share the

same software bus as the OS engines and some might work entirely through OS functions while others might add new functions. It will be possible to treat any application as a new engine for building further applications.

Programming for the user (as opposed to the systems programmer) will be by example. You step through a job sequence in 'learn mode' and then save the resulting sequence as an intelligent 'Agent' which performs your customised task; the Agent can be generalised by asking you to enter data and parameters at run time. Think of it as a keyboard macro-cum-pipe-cum-batch file-cum-job control program to the hundredth power. The Worksheet's transparent ISDN communication means some of the engines used by an Agent might be on a remote computer. It might enter a colleague's machine to arrange a meeting timetable for example, or enter an airline's computer to check flight times. For incorrigibly 'techie' users, agents might also be constructed by drawing flow charts on the screen rather than by pure example.

OS/2000 will contain a full scale object-orientated database engine whose file structures will be designed to facilitate hypertext-style cross referencing between the contents of different documents, rather than using a simple hierarchical tree structure like PC-DOS and Unix. The large amount of indexing necessary to achieve this will be performed 'on the fly' in most cases. For example, as you are typing text into the Worksheet, OS/2000 will examine each word after you press the space bar, look

it up using the built-in string-search engine and dictionary and consider it as a candidate for indexing. You will have already defined the categories for cross reference.

On the other hand, when you load data in batch mode (for instance, downloading a file via ISDN), the string-search engine will be used to filter the file for indexable words in background mode. Spell-checking and many other such text manipulations will also be continuously performed on the input stream by the OS rather than any application — there will be an OS call which says 'was the last input token a correctly spelled word in English/French/Spanish . . .'

OS/2000's drawing engine will process a high-level graphical description language (a hugely more powerful successor to PostScript) which will also be used as the communications protocol for sending 'faxes' over an ISDN line. It will employ a fractal-based data compression technique to squash bit-mapped images several thousand fold and allow them to be included as 'literals' in a vector description of a picture.

Connectivity

Given that the pressure for standardisation in connectivity is going to increase over the coming years (indeed, the latter is practically impossible without a good dollop of the former), the Worksheet will make extensive use of expected standards for the year 2000.

In particular, these include optical communications technology and Integrated Services Digital Network (ISDN) standards. Both of these are expected to have a significant place in overall systems design by 2000, so it seems logical to make use of the same technology.

By then, there should be many ISDN-based services and products available, so there will be opportunities to exploit both these and the economies of scale which will arise in chip design and manufacture. In turn the standard will promote the appearance of peripheral systems, such as printers, which make use of the standard interface.

And that interface? The Worksheet will use two optical ports capable of handling all I/O requirements. As they are optical, there need not necessarily be a physical link to the outside world — it will be sufficient to rest The Worksheet onto a desk-based cradle for connection. Optics have been selected as the best option for handling the transmission speed; optical networks running at 32Mbits per second are already available.

The system will utilise a single-chip ISDN I/O controller capable of running the necessary two B Channels at the

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prevailing standard transmission rate (currently 64kbits per second), and a D Channel operating as fast as 64Mbits per second. The former pair may seem slow, but there is already considerable pressure and argument between a number of countries' telecommunications authorities about pushing this up. Also, they are primarily concerned with the link at the major systems level with the telecommunications network. The D Channel has optional data rates and can be used for 'internal' systems communications.

By the year 2000, semiconductor technology will be capable of producing controllers running at much higher speeds. Motorola is already offering a chip set running at over 2Mbits per second, for example, so 64Mbits per second is quite feasible in the timescale.

The reason for selecting ISDN standards is precisely that. It will undoubtedly be the prevalent standard by then, with a wide range of applications and support services available. Voice and TV will follow. This latter will probably be helped by utilising techniques similar to Slow-scan, transmitting changed elements of a picture only, thus reducing the bandwidth requirements.

In addition, there will be a wide range of services available from third parties based on ISDN communications. These will range from products such as printers and mass storage devices which are part of a larger office system at a place of work, through domestic management/entertainment systems, and on to general services which will be available over the public telecommunications network.

Because the wide area network connectivity will be transparent, it will be easy for users to rent data storage space from third-party vendors. And while one may wish to avoid the heavy charges associated with becoming overdrawn at the memory bank, both RAM and applications may be used remotely via the ISDN link.

Many of the applications for the Worksheet will be making demands on communicating with those systems and services via ISDN, rather than any direct link between the PC and the specific device. There will rarely be, for example, the need to go scrabbling round the back of the box changing printer cables or links into the serial ports.

Everything will go via the single optical port, with everything working to the same standard, either into the office or home system or into a specific peripheral. Most times, where such peripherals are printers or storage systems, they will be part of the office or home system anyway.

The availability of CT2 or 'zonephone' points where telecommunications can be established using your personal device, be it phone or Worksheet, just by standing within a certain distance of a physical marker — will mean that, even away from your desk or home, you will be able to access the ISDN network. Add-ons will allow for similarly transparent satellite links. Because local peripherals such as printers, and remote facilities such as online databases, are all ISDN devices, it will be possible to access your own office printer from a train station zonephone point any distance away as easily as checking the stock reports.

A single port might seem restrictive, but in most cases where the users want to do more than one thing at a time, they will communicate via the port with services controlled by other compatible systems (such as at the office or home).

The port will, of course, link with a telephone, cellular or otherwise, but does not have a phone built in. That actually reduces the flexibility and convenience of both.

Interface
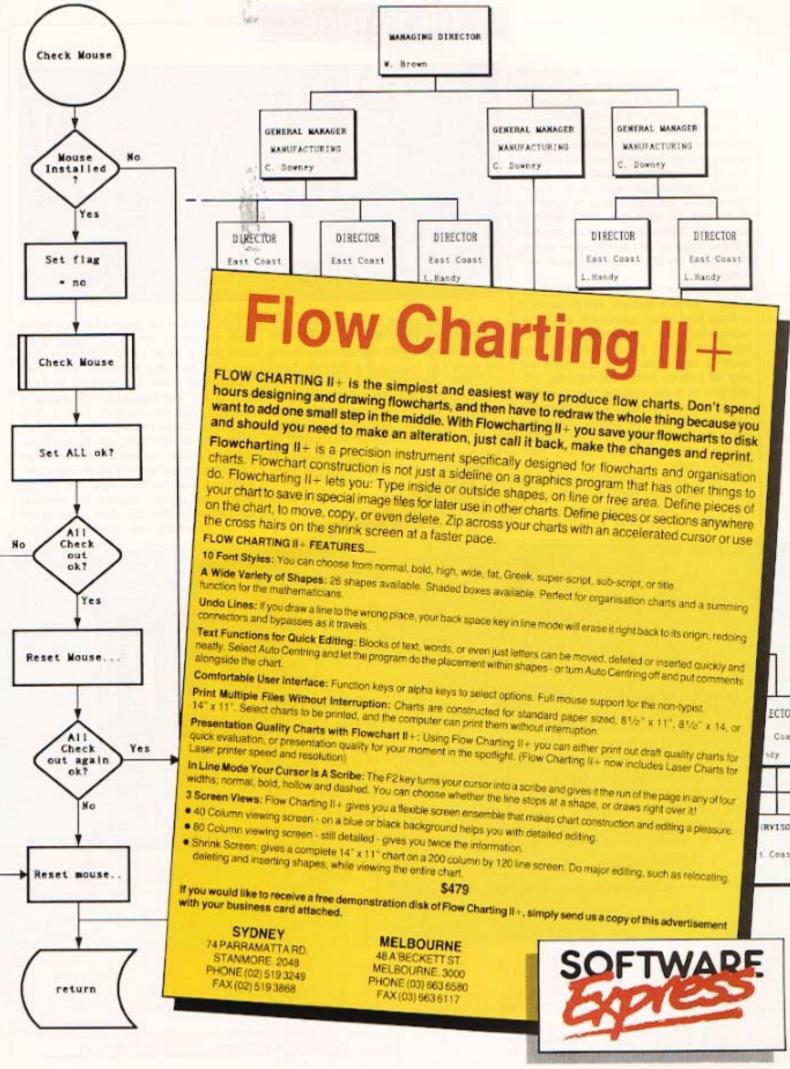
The Worksheet will use a graphic windows-based user interface. Common to all applications will be Worksheet-based objects to represent tasks, files, applications, background tasks or services, and a 'soft' keyboard. But in addition there will be a 'natural' integration of keystrokes and mouse-derived pointing with handwriting and gestures to perform functions.

The Worksheet will not have a keyboard separate from the display. Keyboards, together with other buttons, sliders and so on, will be represented on the touch-sensitive screen and you will type, tap, slide or point to these objects as if they were knobs on a radio or keys on a conventional keyboard.

The difference is that you won't have to make the same keyboard fulfil the different input needs of many different applications. Each application will define its own set of areas which will respond to the touch of a stylus or finger.

Some applications, such as text entry, require a QWERTY keyboard. Most people type faster than they can write, and part of the touch-sensitive screen in the text editor will be mapped as a conventional full-size keyboard complete with audible click if you want it. When there is much numeric work to do, such as in a spreadsheet, then the application may offer you the opportunity to turn the Worksheet physically through 90 degrees into landscape mode, with a wide spreadsheet and, instead of a
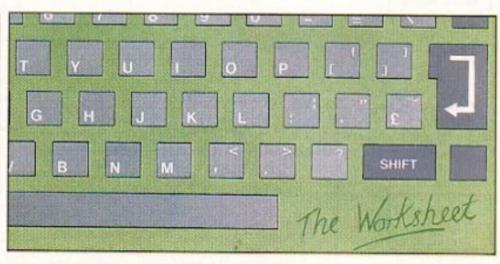
QWERTY keyboard, just a numeric keypad. Handwritten notes can be used to enter the smaller amounts of textual information found in a spreadsheet.

In this way each application can present its own ideal keyboard. For a paint package there will be paint pots for you to dip your stylus brush into. For a music application maybe a representation of the instruments or even the orchestra so that, hovering slightly above the Worksheet, you can conduct the orchestra as you compose — writing the notes on the musical staves on-screen.

Much greater use will be made of application-specific buttons. For example, it is likely that every application will place somewhere on the display a button labelled 'Help'. In a text editor, functions such as save, load, font and style will also be buttons with clear legends. Hitting one of these buttons may summon up more choice of buttons to replace the first, or even a menu, placed not at the top of the screen, but at the point of the previous screen contact where your gaze still rests.

So while every application may make use of what are currently called function keys, these will be appropriately and dynamically labelled so that only

relevant buttons will be visible on-screen at any time. There seems no point in presenting you with options which are not valid. Our hope is that the rude beep and 'Bad Command or Filename' message will be truly banished. If computers are so clever why should they allow you to make mistakes? And no longer will we have to tolerate computer pedants arguing about whether F3 or ^JH is the easiest way to get help. When you want help you hit the 'Help' button.

Renaming a document will be a simple matter of pointing to the old name and writing a new name on top of it. Sending

a document or an application to another user will be as simple as 'dragging' its icon onto an icon of the telephone. You will also be able to create your own handwritten shorthand symbols for both simple and complex tasks. To delete a file you may just scribble over it. You may find 'double clicking' a less satisfactory way of selecting an object than drawing a circle around it. A mailmerge could be started by hitting the form letter, writing a plus symbol anywhere on the Worksheet surface, tapping the relevant database symbol and then drawing an arrow towards the required output

The Worksheet

"How Much?"

My partner would rather have teeth extracted from his mouth than dollars from our business. This was not the first time I had broached the subject of us buying an accounting package.

"We need a good, robust package to give us an accurate picture of how the business is progressing."

"Agreed. But we can't afford it."

I was prepared for this.
"DeskTop Accountant", I suggested quietly.

"We would need a full set of ledgers — all integrated ..."

"DeskTop Accountant", I repeated a little louder.

"... Invoicing, statements, comprehensive reporting and it would have to be able to grow with us ..."

"DeskTop Accountant" I said, finally getting his attention.

"The package must be suitable for Australian accounting."

"DeskTop Accountant."

"We'll need software support", he said through clenched teeth.

"DeskTop Accountant", I was beginning to enjoy this.

"We can't afford it", he snarled.
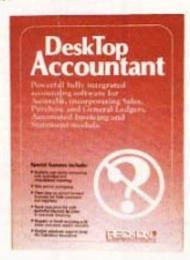
"DeskTop Accountant was designed and proven in Britain, but is published in Australia — no hefty shipping and import costs to be passed on. The publishers support it too. Moreover, Reckon has discovered that 60% of small businesses like ours have little or no requirement for stock control. So we don't have to pay for it."

"How much?"

"$595.00" Checkmate, I thought, smiling triumphantly.

"I guess we'd better buy a copy", he conceded.

"Quite."

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device. Doodling will become a potent computer programming language.

Many predictions of future computing have stressed the value of sound — both speech input and sound output. Sound will be used appropriately in the Worksheet. When you need help, it may be better that the application describes to you audibly what is on the screen rather than covering an already confusing picture with yet more visual information. It could ask you to point at what you want help with in an instant interactive training session. Sound cues will be used to signal the arrival of electronic

mail in the way that we now respond to the footsteps of the postman and the sliding of letters under the door. User control could, for example, allow you to allocate the sound of a clanking letter box flap to this activity if your prefer it.

Speech input will be available as an additional feature. Just as sound cues can cut across the clutter of a visual display, so speech commands can be used to access the Worksheet through the 'back door'. At a time when your screen is occupied with a set of database forms, you may wish to start a process of collecting your electronic mail, or looking up

news stories in an online news service. Rather than remove your attention from your current activity you will be able to use speech as a secondary communications channel. 'Computer, collect my mail' will suffice as you continue to read the small print on a Worksheet representation of your pension scheme application form. The computer will also acknowledge this command with an audible signal and among your active task icons, a new symbol representing that task will automatically appear. When the mail has been collected a bell may sound and the icon may flash, or change colour to indicate that the task is complete.

Customisation will be a major advantage of the user interface. Some people like pictorial icons and you may select or design your own symbols to represent functions and activities. Others feel happier with words and the Worksheet desktop can be as much a domain of text lists as icons. Either way, you will activate them using the stylus to point or gesture at the chosen object. And if you decide you like your appropriately labelled function keys along the top of the virtual keyboard, you will be able to place them there or wherever you wish. The computer will, of course,

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42 MB 5¼" Drive 28 MS with Controller & Kit	$1080
71 MB 3½" Drive 26 MS	$1080
71 MB 3½" Drive 26 MS with Controller & Kit	$1230

automatically remember your preferences, even if they relate to a remote application.

Although many people use multiple windows on-screen to represent various multi-tasking activities, most applications and people in fact work best on a full screen. The page metaphor will become very strong. Changing from one application to another will be as easy as turning the page of a book. On one page will be your text editor, on the next your desktop publishing application, on the next your database of personal contacts, and at the back maybe your own personal newspaper made up from the wire services.

Small windows present only part of a picture and it is likely that most users will actually page rather than tile their way through their tasks. Simple screen-based buttons to page backwards or forwards will become a standard feature. For cut-and-paste jobs, or for those times when you just want to sit back and watch your various computer domains work away on their own, traditional overlapping and tiled windows will, of course, be available. When you size a window you will have the option of viewing a portion of the whole application or of seeing the full screen scaled down.

The Worksheet display will handle video images as easily as text or graphics. A user-defined area will be able to show slow-scan closed-circuit TV pictures of your visitors on the doorstep, your sleeping child, or sampling frames of current TV programs (so you know when the late night news is about to start).

Applications

All this high-techery may be wonderful in itself, but what will the Worksheet be like in use? What will happen when you hit that 'on' switch?

In front of you, you will see a sheet of electronic paper. Firstly, you sign your name across it — a signature, with its characteristic patterns of pressure, speed and shape is the best password. Having validated you as its rightful owner, the Worksheet will use its adaptive defaults to offer you the configuration it guesses you will want.

Say it's 9am, the time you normally start work. The system might, as a safe bet, bring up the document you were in the middle of revising when you stopped yesterday. At around 300 pixels to the inch, it's close to current laser print quality but covered with handwritten

marks and jottings where you've indicated changes that are awaiting confirmation. You move text around for a while then tap the bottom of the display with your finger and the keyboard appears — arranged in your preferred layout — and you carry on typing. Doodle in the margin as you gather your thoughts and your scribbles flow from the stylus just like ink.

But run a drawing program in the machine and that spidery sketch turns beneath your moving pen into a flow chart of neat rectangles, centred labels and straight lines. Scrawl a round ring around it, tap the fax icon and you can send it straight to Tokyo. Strike it out with a quick flourish and the picture self-erases.

Read it, write it, rub it out and start again. No longer a super-calculator, nor even a desktop, the computer is now a sheet of magic paper. Being so chameleon-like, computers have always been defined by such metaphors. But what the future holds is computers as mass media.

Having dispatched your diagram, you decide to check what's happening in the world. Drag open a window on the screen and there is the TV news; gesture at the window with your stylus and it

instantly zooms out to a full screen. Something catches your attention and you want more information — the TV program can be replaced by a broadcast newspaper with hypertext links between stories and on to more detailed background articles. Like conventional newspapers, the page is laid out with diagrams and photographs. But now, tap any of these pictures and they turn into video sequences and animated drawings. Flick the corner of the screen and you turn the page.

By putting input and output into the same device, you have — for the first time — the possibility of truly intuitive in-

both of them could be sitting in the park, a thousand miles apart.

Perhaps the most ironic aspect of the Worksheet is that, more than ever before in the history of computing, your working environment will resemble the world around you. The electronic paper screen you work on will act just like a paper pad, your diary, a whiteboard or a canvas.

Electronic banking will present you with a cheque to sign that will look like a real cheque (complete with badgers in the

background if you wish) and require you to place a real signature on it. In database work you will use forms and charts that more closely resemble old-fashioned hand data entry and sketches than the rigorous fields and graphs of the current computer environment. It may even be possible for you to 'grab' the top page of the screen with your fingers and scrunch it into a ball when you want to abandon a badly written document and consign it to the bin.

END

teraction with the application. Run a spreadsheet and there is the numeric key pad that you can slide anywhere on the screen. Play chess and you can move the pieces with your finger. You need to fill in a form at the Post Office? The Worksheet sets into the counter displays the blank form ready for handwritten entry. Use a painting program and, as you lift the stylus off the screen, it softens the line just as if you were holding an airbrush. The Worksheet is a tool of illusion.

Yes, of course, we'll have access to vast databases and to home shopping but, above all, the applications of tomorrow will offer a much clearer window on reality.

You don't just get a picture of the new video recorder you're thinking of ordering but, touch the buttons in the picture and you can operate it before you buy. The stage designer working on a new set can see it with the costumes that are being designed by someone else. And

Institute for the Future

Founded in the 1960s by a group of idealistic scientists, the Institute for the Future is out to teach us how we can use technology to shape our future. John Sterlicchi, ex-editor of Computing Australia newspaper, and Stephanie Hafner visit the headquarters in Silicon Valley.

Elsewhere in this magnum opus of a magazine you will find prophets pontificating on the future. It's undoubtedly good fun to let the imagination roll once in a while . . . but can you believe crystal-ball gazing as a fulltime job?

Well, that's what happens at the esoterically-named Institute for the Future in crazy ol' California, where forecasting the trends of the world's next electronic decade is a commonplace occurrence.

The low-profile Institute, operating on a $US2 million yearly budget and stocked with a heady group of the nation's brightest and most heavily-degreed research fellows, is a non-profit futures research organisation nestled in the quiet hills of Menlo Park, California.

Its unassuming headquarters contains the offices of 20 scientific researchers dedicated to assisting businesses, industry and the US Government in determining how the technological world will change, and how that change will affect management, productivity and society.

In addition to its diverse staff, the Institute makes extensive use of several hundred outside consultants. These experts are selected to research the issues the organisation wants to explore, for example the area of groupware or videotex, which the Institute has researched for 10 years.

Establishment

Founded in 1968 by a group of idealistic Rand and Stanford Research Institute scientists who wanted to apply military forecasting tools to research outside the defence community, the Institute for the Future was formed with the solid intention of making a significant contribution to humanity. Among the group were Paul Baran (inventor of packet switching, a technology originally designed for the

US military that enables many computer users to communicate simultaneously and inexpensively on a single network), Olaf Helmer (a Rand mathematician), and current president Roy Amara.

"The feeling was that research techniques like expert judgment, statistical models and writing scenarios had been used primarily to solve military problems," said Amara. "We thought there should be an organisation in which these tools could be applied to non-defence areas. So one of the principles of our company is that we do not do any classified work for the Defense Department — the work has to be unclassified."

Twenty years later, the small firm still has some reservations about its name. Understandably to our minds.

"Institute for the Future sounds a little off-the-wall to some clients," said Amara. "Less so today than it did 20 years ago — it's become a little more respectable to think about the future. But even today there are people who worry or wonder whether this is an encounter group of some kind."

Amara, wisely, is careful never to use the word 'prediction' in describing his company.

"We're fairly pragmatic . . . we're not blue-sky futures researchers looking at space travel or personal helicopters. We don't purport to say exactly what the future will be like, simply because there are too many imponderables and too much uncertainty. And, in fact, our clients are interested in those areas of technology where uncertainty is the greatest, because if they could simply lay a straight edge on history or prior data, then they wouldn't need the services of any organisation. So we're looking for structural changes, discontinuities, breakpoints where the future is likely to be quite different from the past."

The founding group, which originally began its venture on the east coast, two years later moved its headquarters to Menlo Park, on the edge of Silicon Valley.

"Our original idea was to have an organisation that would systematically look at the future in a wide number of areas. At the time, we wanted to work primarily for the public sector . . . mostly for the Federal or State Government, looking at housing, unemployment, poverty, education, health; we had grandiose visions about how big it should get. After the first

year or two, it turned out that the country went into a recession, and funding was cut. The original vision had to be compromised. There just wasn't a lot of public sector money, and the organisation almost went down the drain. What saved it was really the fact that we turned our attention toward the private sector, which was an unknown sector [for this business]."

Cynosure

Although interesting 1970s businessmen in the future was a radical notion, it was precisely that risk that saved the Institute from mortality.

"It's a radical notion even today in some quarters, but much less so," said Amara, speaking of industry investing money in futures research. "Slowly and surely we've built up a very large clientele, but we've never been tempted to grow to the point where, if times got tough, we'd have to retrench. That's one reason for staying small. But another reason is that I really don't think this kind of work can be done in very large organisations. We don't want to grow so much that we have to compromise quality, or do things we shouldn't be

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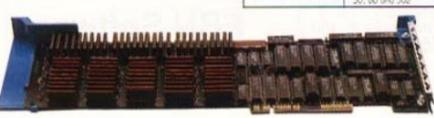
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Hyperam/MF	IBM PCs, XTs and compatibles	512Kb-2Mb	System Expanded (LIM)	1 parallel 1 serial clock calendar 2nd serial optional
Hyperam 30	IBM PS/2 Model 30	512Kb-2Mb	Expanded (LIM)	N/A
Hyperam 30/MF	IBM PS/2 Model 30	512Kb-2Mb	Expanded (LIM)	1 parallel 1 serial
Hyperam AT	IBM ATs and compatibles	512Kb-2Mb	System Expanded (LIM) Extended	N/A
Hyperam AT/MF	IBM ATs and compatibles	512Kb-2Mb	System Expanded (LIM) Extended	1 parallel 1 serial 2nd serial optional
Hyperam 50/60 2Mb	IBM PS/2 Models 50, 60 and 50z	512Kb-2Mb	Expanded (LIM) Extended	N/A
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doing, simply because we want to stay alive rather than make a contribution. We've been at this size of 20 staff members for 10 years now, and we don't expect to grow very much. We may add five people in the next several years. We like to be small and high quality, and able to determine our own future. Right now, in order to remain as independent as possible, our staff involves itself with about 15 different clients at a time. We don't want to be beholden to any one client."

The Institute focuses its research efforts on several areas of information technology within a five to 10-year time frame. Some of these technologies include conferencing systems. teleservices, communications services to the home (such as videotex), education, and, in the last five years, the rapidly growing field of health care. As the company grows, it is gathering more globally oriented clients based outside the US, for example France, Televerket in Sweden and the UK. And the company is beginning to explore the Japanese market.

Like high-tech manufacturing and marketing firms, the organisation relies increasingly on joint ventures, such as its co-operative agreement in the health-care field with Louis Harris and Associates, a New York survey research firm, as well as other projects with individual researchers. In this way, the Institute can combine the skills of a survey researcher with a forecaster.

"It's a sign of the times that joint ventures or partnerships are as much a part of our world as they are for the client, and the reason for that is that client needs have become more complex. So one needs more complex approaches that draw heavily from a variety of fields," said Amara. "An easy way to do that, particularly with an organisation of our size, is to join hands with other organisations."

Modus operandi

Amara cites three different approaches to the staff's research methodology: expert judgment, statistical models and scenarios or constructs.

Using the concept of expert judgment, researchers elicit information from authorities in a structured way. Some of the information is quantitative in nature or obtained through individual interviews, while other information is gathered by

artfully grouping together an array of open-minded experts who show willingness to share their current observations and future projections with others. The information is then combined to provide a future view of the issues explored.

"In the workshop setting, we bring 10 to 12 experts together, and we keep them together for a day or two, taking them through some processes that permit them to interact, as well as to offer individual opinions. We come in with a lot of data about the past, about history. Then we ask them to identify driving forces through a process where each makes an individual written forecast, in private, using sheets of paper we provide with data about the past. So it isn't just a lot of guesswork and people waving their arms. Then the differences are discussed, and they may be given another opportunity to revise their forecast. We're not trying to force them into some kind of consensus. We're trying to get them to do their most creative thinking, individually and on a group basis. Clearly the group interaction is important, and we'd like to think that some of them will learn something from the process as well — which is why they often come."

Combining the right kinds of people for the sessions is crucial, and creating the mixture is an art form, emphasised Amara, who said that the right kinds of people are not always the leading experts in their field. The participants need to have open minds with respect to relating to the group and to be able to use their "peripheral vision" with flexibility.

"You can't use a cookbook set of rules," said Amara. "We've made lots of mistakes. It requires knowing something about who the key individuals are and checking them out. We're never sure, after we've assembled such a group, that we haven't left out some key individual who may have completely turned the thing around. That's why this is not a science, even though there are elements of science involved. We can never be sure that the way we've come out is the way that the future is going to unfold."

The Institute's staff commonly uses the concept of expert judgment to make forecasts about a technology or a development in its earliest stages for which there is little history to extrapolate information. For new technologies, researchers have difficulty using analogies. For example, it would not be valid to say that because a consumer bought a CB radio at the height of their popularity 10 years ago, he would buy a compact disk player today. Technologies have a life of their own.

The forecaster's goal is to understand the driving forces encouraging growth, as well as those inhibiting growth, before making judgments as to how those forces are likely to play out within the next several years.

In principle, expert judgment can be applied to any technology, although it is often easier and less treacherous to forecast the size of a market that involves a business need rather than a consumer need. The decision-making process by which business needs are met is more rational than the process by which consumer needs are met. Said Amara:

"Usually, businesses don't buy equipment or adopt new technology just for the hell of it. They try to meet some need, which may be to increase productivity, reduce response time, get a competitive advantage or reduce costs. Whereas in the consumer market it is much more difficult to understand why people buy things. It's more emotional or subjective, and there's such diversity. And it's also more faddish."

Another research technique the Institute uses is the building of models that may rely on expert judgment in combination with statistical relationships.

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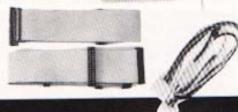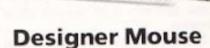
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ten scenarios. Scenarios are constructs, ways of describing alternative futures where there is a fair amount of uncertainty. The firm's researchers try to capture that uncertainty in tool form by describing a future that unfolds in more than one fashion. This technique bounds the range of uncertainty without saying that either scenario is the predictable future, and the Institute underscores the fact that either carefully constructed scenario is an equally likely occurrence.

"Clients usually have difficulty opting for one scenario or the other," said Amara. "They may say, 'Gee, I'll just pick this one and ignore that one'. Clients often do that. But then we say, 'Fine, you can do that and base all your planning on one of them, but remember that you can be wrong. And what you may be doing is betting your entire company on a false premise'. "

In the double-construct situation, the client usually asks, "What do I do with these scenarios?"

As usual, the Institute has several answers.

"We may try to construct a third one that is some mixture of the others," said Amara. "Or the client may hold back,

saying, 'I'm not prepared to commit my resources without more information'. And so we sensitise the client to understand what he should look for to make a future determination that veers one way or another. Or a client can bet on one future, but hedge his bets on another to buy insurance — so that he doesn't go whole hog."

It may sound like a board game, but the reason for the intrigue is not just to have fun, explained Amara.

"It is to help someone make a decision now, not in the future, but now, about allocating some resource — investing money, assigning or hiring people, or building things. And you can't pull these things back without losses, so [the expenditures] have to be premised on some picture of their future, which we try to give our client. We provide a little input that may make their decision a little better with respect to whatever objective they may have: to make huge profits, improve society, maybe to have fun."

Groupware project
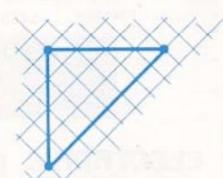
One multi-client study currently underway at the Institute is a groupware

project headed by public policy analyst Robert Mittman.

"The groupware project is a study in which we have three clients. Each client is interested in benefiting from groupware and getting ahead of the wave. They want to learn the technologies and the organisational impact of groupware, and try to integrate it into the work of some of their business teams ahead of the bulk of the businesses," said Mittman.

In this project, Mittman instituted the process of working closely with a business team from each of the clients. His goal: to help each team understand how it can increase its performance by using groupware approaches. In an additional aspect of the project, Mittman designed an approach in which the three clients will meet jointly to discuss general learnings.

The group, facilitated by the Institute's researchers, will exchange some of their information, and a framework will be documented.

"We want to understand what kinds of needs the business teams have, and tie those needs to specific groupware products that are compatible with those needs," said Mittman. "In a third step,

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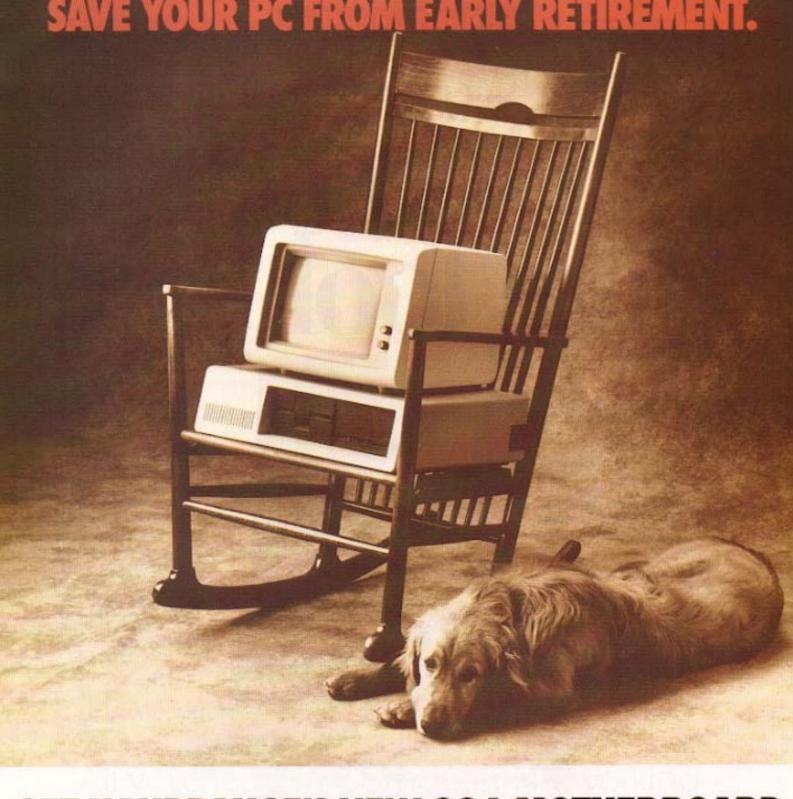
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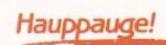
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the project team will publish a groupware guide that will help managers understand some of the learnings from the experience."

Mittman emphasised that an important aspect of the Institute is to take the learnings acquired through proprietary work and offer the knowledge to society, through publications. One recent offering is a book by the Institute's New Technologies Program director Robert Johansen, entitled 'Groupware — Computer Support for Business Teams'. The Institute for the Future also regularly publishes a Corporate Associates Program report, a monthly newsletter called 'Perspectives', and a 10-year forecast report.

Although most of the Institute's clients involve ongoing relationships, new clients usually come in with one of three questions concerning a specific technology: How do we make it? How do we use it? And how does it affect our mission?

"Companies want to know how they can turn a technology into a product six to 10 years from now," said attorney and futures researcher Paul Saffo. "They're asking how to use the information to their competitive advantage. In that regard, we're technology scouts. We say, 'Here are the events. This is what you've overlooked, and here are the implications for your future'. Government agencies and foundations draw on our 10-year forecast, particularly for research into crime control."

Conclusion

Clearly, the Institute for the Future not only has far-reaching effects for its clients, but also for its researchers, who tend to integrate their scientific orientation with philosophical overtones.

"I once thought of technology as a driving force for change," said Saffo. "Now I see it not as a driving force, but an enabling force, broadening my options rather than narrowing them. We are not pushed by technology to an inevitable end in which we have no choice. If we get involved early, and we choose how to use the technology, we can use it to shape our futures. Technology does not shape us; it creates a choice."

END

Workgroup solutions

Banyan's gateway local area network creates a portal that lets PC workstations share expensive mainframe connections through a single link. In the first of a two-part series, Frank Derfler reviews this flexible gateway for an expanding communications environment.

In the best of all possible worlds of PC/mainframe coexistence, the PC serves as a window into the corporate information environment of the mainframe. True, entry into this optimal world has been attainable ever since DCA's introduction of the IRMA card. With IRMA — or any of its competitors' products — installed, PCs can double as IBM mainframe terminals. And the mere touch of a key toggles you between local DOS programs and mainframe processes. You don't even have to consider the use of separate PC and mainframe terminals or, especially, having to rekey the data in order to share it between them.

As always, however, increasing technical sophistication has made us hungry for something better. The problem with coaxially connected products like IRMA is that they require each PC using them to maintain a dedicated — and expensive — link to the mainframe, even if that connection is used only sporadically.

If your firm has installed a local area network to allow your PCs to share data files and peripheral devices, you have another option: why not use the LAN to share expensive links to the mainframe system? LAN gateways establish a portal that allows all connected stations to access the mainframe through a single link.

Approach to gateways

APC's two-part series on gateways, which continues in the February issue, limits its coverage to gateways using the IBM Systems Network Architecture (SNA) protocol, the fastest-growing mainframe connection scheme. All products tested emulate an IBM 3274 cluster controller attached to the mainframe through a front-end proces-

> '. . . every Banyan Corporate Network Server contains an integrated battery backup . . . that notifies users when the server loses power, then gracefully shuts down — only after closing all open files.'

sor by means of a 19.2kbit-per-second RS232C link.

In this issue, we review Banyan Systems' Corporate Network Server. It is a complete local area network with gateway services built into a dedicated file and print server. The next issue will include a look at several open systems: generic add-in LAN gateways that can reside in nearly any PC on nearly any modern PC-based LAN.

If you need to link PCs to IBM mainframe systems and already have a LAN installed, look at the add-in gateway products we review in the next issue. If you don't yet have a LAN or are unhappy with what you do have, the Banyan product can give great service with plenty of room to grow.

A new look

APC reviewed Banyan's VINES operating system in June, but did not focus on the VINES gateway services. New in this review is a description of Banyan's latest software release, version 3.0 of VINES, along with Banyan's new Corporate Network Server, which is based on the 80386 processor.

VINES' network operating system is based on Unix, however it understands and emulates DOS when communicating with the workstations. It hides Unix from all but those with factory-authorised passwords, and Unix furnishes important multi-tasking capabilities.

In terms of hardware, each system consists of a floor-standing computer that can continuously operate several high-capacity hard disk drives, a tape backup unit, several printer and communications ports, and many megabytes of internal memory. Both the hardware and the LAN operating systems used in these products are 'commercial grade' — their performance, in other words,

rates at the upper limits of all LAN systems.

No easy installation

Installing any LAN gateway requires collaboration between the LAN system administrator and people with special skills on the mainframe end — the systems programmers. People on both sides of the link must set numerous electrical and software parameters to ensure effective terminal operation and file transfer through the gateway. While the software contains menus to make life easier, the initial installation and configuration takes the full attention of someone who has complemented a good practical knowledge of MS-DOS with a three to five-day vendor-run course on the LAN software.

The advantages of systems like the one reviewed here are that they're tightly integrated and bundled; they're supported by a single vendor. Options for adding communications capabilities and interfaces to other types of computers and networks are pre-designed as well.

The gateway systems to be covered in the next issue are more flexible. But while you can push them into existing networks made up of products from several different vendors, you risk incompatibility. So the choices aren't easy.

Gateways and beyond

What's needed, perhaps, is a fuller explanation of where gateways fit in with other methods of PC-to-mainframe com-

> *[VINES'] excellent management features plus a statistical reporting package called Netman present a clear picture of network performance . . .'*

munication through the Systems Network Architecture (SNA). The remainder of this introduction to the Banyan system will be devoted to a tutorial — skip ahead if you're no stranger to the subject.

Before a PC and an IBM mainframe can communicate through the SNA and transfer data between each other, some major obstacles must be circumvented.

The usual way of communicating with such a mainframe is through an IBM 3278 or 3279 terminal (generically known as a '3270' terminal). But the PC's keyboard doesn't have as many keys as a 3270 terminal does, and the terminal has several special graphics characters that aren't in the PC's screen repertoire. The PC also lacks an appropriate communications interface and uses the ASCII data alphabet instead of IBM's mainframe standard, EBCDIC.

There are presently three basic ways to overcome these difficulties: by adding a plug-in card combined with software and/or hardware and making the PC act like a 3270 terminal (IRMA-type solutions); by connecting a protocol converter between the PC and the mainframe that translates the mainframe's data into a form usable by the PC; or by using a gateway LAN.

Know your numbers

Any article that explains how to hook PCs to IBM mainframe computers has to deal with a lot of IBM equipment numbers and describe the IBM network architecture schemes. To begin, IBM's major line of terminals, printers and

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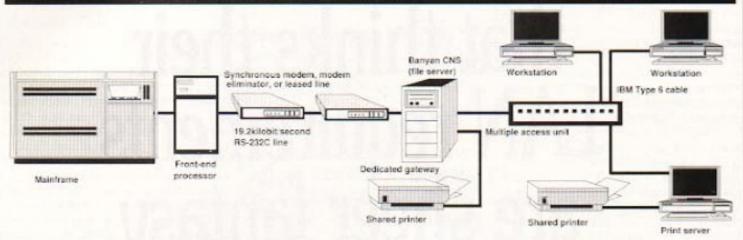
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The Banyan CNS as a gateway into the IBM 3270 architecture

The Banyan Corporate Network Server (CNS), a dedicated gateway, can hold a combination of 80Mbyte, 146Mbyte and 300Mbyte disk drives and a 150Mbyte streaming tape system without an external chassis. Here, the CNS links a mainframe with a shared printer and a multiple access unit (MAU). The MAU acts as a hub connecting the Banyan CNS and up to seven workstations; when several MAUs are connected, the potential number of linked nodes is greatly increased.

other communications devices falls into the general category of the '3270 family' of equipment. Each type of device has a specific model number (many, but by no means all of which, begin with the digits '327'). They're all designed to work in concert to orchestrate users' — both of PCs and other equipment — access to the computing power of the mainframe. Well over two million 3270 family terminals are in use today.

IBM's Systems Network Architecture is its grand scheme for connecting its myriad 3270-family products. It is a flexible protocol and can be configured in several different ways. Here's how the 3270 family of products fits into various SNA setups.

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Benchmark tests: LAN Gateways

Performance times
(Times given in seconds)

Network speed under load

Server	Interface card	Software	Zero stations	Two stations	Four stations	Six stations
IBM PS/2 Model 80	IBM Token-Ring Network	PC LAN	401	419	471	617
Banyan CNS	IBM Token-Ring Network	VINES 3.0	445	479	545	832
Wyse 10MHz 80286	IBM Token-Ring Network	Advanced NetWare 2.0a	330	339	358	485

Hard disk access load

Server	Interface card	Software	Zero stations	Two stations	Four stations	Six stations
IBM PS/2 Model 80	IBM Token-Ring Network	PC LAN	190	190	224	252
Banyan CNS	IBM Token-Ring Network	VINES 3.0	169	296	482	747
Wyse 10MHz 80286	IBM Token-Ring Network	Advanced NetWare 2.0a	165	174	182	198

Database load

Server	Interface card	Software	Zero stations	Two stations	Four stations	Six stations
IBM PS/2 Model 80	IBM Token-Ring Network	PC LAN	190	243	305	363
Banyan CNS	IBM Token-Ring Network	VINES 3.0	169	175	179	183
Wyse 10MHz 80286	IBM Token-Ring Network	Advanced NetWare 2.0a	165	168	170	172

The *APC* benchmark test results showed that a network's performance is not necessarily related to the speed of the chip upon which it is based. On these LAN tests, Novell's Advanced NetWare 2.0a posted the best results overall, even though it used an 80286-based server. But the Banyan Corporate Network Server (CNS) running VINES 3.0, a new version of VINES designed for the 80386, did well: the performance of VINES 3.0 showed a significant improvement over that of previous versions of VINES running on Banyan servers based on the Motorola 68000 family of processors.

The system consisted of the Banyan Corporate Network Server running the VINES 3.0 operating system, with IBM Token-Ring Network adaptor cards for the workstations.

For purposes of comparison, the Banyan network was tested against two popular LAN systems. The IBM system consisted of an IBM PS/2 Model 80 running IBM's PC LAN software. The Novell system consisted of a Wyse 10MHz 80286 machine running Novell's Advanced NetWare, version 2.0a. In both cases, the workstations were connected to the network via IBM Token-Ring Network adaptor cards.

All of these benchmark tests were run using IBM PC XTs as workstations. (Because we needed access to a dedicated mainframe in order to test the gateway performance of these LANs, we were unable to perform the tests on-site. As a result, we were forced to substitute IBM PC XTs for the 8MHz IBM PC/ATs that we normally use as network workstations; only the 'zero stations' test was performed on an 8MHz PC/AT. For this reason, the only test results that can be compared directly to previously published results for other networks are those for the zero-stations tests.)

In a classic 3270 system, each 3278 or 3279 terminal connects to a 3174 or 3274 terminal cluster controller through coaxial cable. The cluster controller acts as a concentrator by gathering messages from the terminals for more efficient transmission to the mainframe.

Groups of cluster controllers attach via a telecommunications line (which can run say 60 metres locally or across the country, through leased telephone lines and modems) to another larger device called a communications controller or a front-end processor (FEP). The common IBM front-end processors are models 3705 and 3725. Other companies, such as ITT Courier, Telex and Lee Data, make products that are 'plug compatible' and compete with IBM's 3270 devices.
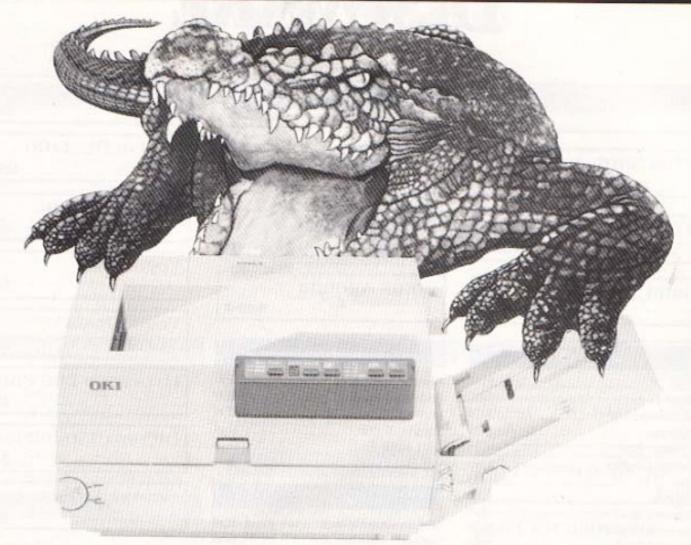
In a relatively recent evolution of the classic plan, IBM gave the 3174 terminal controller, the 3725 FEP, the 3745 communications controller, and other devices the ability to become nodes on a Token-Ring Network. This eliminates the need for a coaxial cable connection between each PC emulating a terminal and the controller, but it requires relatively expensive adaptors and more memory on the 3270 hardware. The introduction of the high-speed 16Mbit-per-second IBM Token-Ring Network this year will require yet another equipment upgrade.

PUs and LUs

In IBM's SNA connection scheme, each terminal or printer connected to the controller is called a physical unit or PU. There are different kinds of PUs with different capabilities. The front-end processor expects to get specific kinds of responses and to send certain kinds of data from and to each type of PU.

Each PU holds one or more logical units or LUs; these address and interact with the host in an SNA network. It is actually the LU, typically a program, that does the work that's transmitted over the communications link. IBM's Virtual Telecommunications Access Method (VTAM) software, which runs in the mainframe, works with the Network Control Program (NCP) in the front-end processor to recognise, configure and communicate with the LUs.

During operation, the 3278/9 terminals send messages called scan codes to the cluster controller each time a key is pressed. The cluster controller echoes the keystrokes back to the terminal so that they are confirmed and displayed on the screen. Data from the mainframe host goes in steps through the front-end processor, to the cluster controller, and into a display buffer in the terminal.

Benchmark tests: LAN Gateways (continued)

Throughput tests
(Longer bars represent better performance)
Relative times

Banyan CNS   DCA IRMALAN   IBM 3270 LAN Gateway

File transfer
User response (system unloaded)
User response (system loaded)

Performance time tests
(Shorter bars represent better performance)
Relative performance

Banyan CNS   DCA IRMALAN   IBM 3270 LAN Gateway

Terminal-to-mainframe screen-buffer dump
Mainframe-to-terminal large-block throughput
Mainframe-to-terminal small-block throughput

Throughput tests
(Results given in bits per second)

Performance time tests
(Results given in seconds)

	Mainframe-to-terminal small-block throughput	Mainframe-to-terminal large-block throughput	Terminal-to-mainframe screen-buffer dump	User response (system loaded)	User response (system unloaded)	File transfer
Banyan CNS	14,529	16,095	14,153	4.8	2.7	112
DCA IRMALAN	14,093	16,084	15,248	4.3	2.4	64
IBM 3270 LAN Gateway	15,613	17,655	15,991	4.4	2.2	60

Results for the mainframe-to-terminal small-block throughput test are important to users who want their PCs to emulate a terminal so that they can enter data into the mainframe.

Performance on this test is important to users who want to page through screens of data contained on their mainframe, such as records in its database management system.

Data coming to the terminal for screen presentation is handled in blocks called fields; these can vary in length from a few characters to a whole screen. The size and characteristics of the field depend on what the terminal finds in the display buffer. Characteristics like blinking, reverse video, seven-colour displays and underlining are defined by modified characters containing extended attribute bytes. These bytes give different meaning to EBCDIC characters to let them represent functions not ordinarily handled in the 8-bit data alphabet the 3270 terminals use.

Easy transfers

Simple file transfers between a PC and mainframe are often done using an IBM editing utility on the mainframe called INDSFILE. This method of moving data is effective, but it's slow. Software that speeds file transfers between the PC and the host is available.

Making mainframe data easily available to PC applications is another task for paired PC-host software. Many companies (Lotus Development Corporation, for example) market software for the PC that extracts data from mainframe systems for PC applications.

Banyan Corporate Network Server

The June issue of APC looked at the VINES operating system running on a 32-bit Banyan server powered by a Motorola 68000 processor. This review covers Banyan's latest release of VINES, version 3.0, used with the 80386-powered Banyan Corporate Network Server (CNS). The Banyan CNS is a dedicated machine that requires a separate terminal connected via RS-232C to control and monitor the VINES operating system. VINES is based on Unix, and each separate feature of VINES, like electronic mail or 3270 communications, runs as a separate task in the server.

VINES background

Our previous review of VINES detailed the power and flexibility of this software. The program automatically configures itself to work with network interface cards from a wide variety of manufacturers. Its excellent management features plus a statistical reporting package called Netman present a clear picture of network performance as well. VINES has strong

communications capabilities, including remote dial-in and server-to-server connections over X.25 packet-switched networks and wide-area networks using leased telephone lines.

VINES 3.0 is a new adaptation of the operating system for '386-based machines. A version of VINES was available for 80286 machines, but it wasn't strongly marketed by Banyan because of performance. As the benchmark tests show, VINES 3.0 is no clinging vine: it moves!

Previous benchmark tests of VINES showed that the system slowed disproportionately in our small-block-size (512 byte) transfer exercise. LAN tasks like file transfer and print spooling are done in larger, more economical block sizes. Small data blocks are used when databases and other multi-user programs share files. VINES 3.0 did significantly better in small-data-block transfers than previous versions of the program have done.

Banyan's CNS

The Banyan Corporate Network Server is a floor-pedestal computer, 65.5 by 25.4 by 66cm (HWD); it weighs 36.3kg. The CNS can hold a combination of

80Mbyte, 146Mbyte and 300Mbyte disk drives and a 150Mbyte streaming tape system for both backup and loading of the operating system. If you use an external chassis, you can access up to 2.5 gigabytes of disk storage. You can put up to 24Mbytes of memory into the CNS to feed its 20MHz 80386 processor.

Cards inserted into seven AT-compatible expansion slots handle connections for communications ports and up to

four separate networks. A built-in SCSI bus controls data-storage peripherals. You can also attach up to seven local printers through the four serial and three parallel printer ports, which do not interfere with the communications ports.

One nice touch is that every Banyan Corporate Network Server contains an integrated battery backup (now you know where the 36.3kg come from) that notifies users when the server loses power, then gracefully shuts down — only after closing all open files. When the server's power returns, the PCs that are still operating automatically reconnect to the server.

Gateway operations

To the front-end processor, the VINES 3270 communications services make the Banyan Corporate Network Server look like a terminal cluster controller. The CNS can link to the front-end processor with a maximum of three SNA communications lines, and the gateway can distribute 32 mainframe sessions among the network workstations for each communications line. While the CNS emulates a 3274, it cannot attach real 3278/9 terminals to the system.

CONNECTIVITY

A glossary of networking terms

ASCII American Standard Code for Information Interchange. The data alphabet used in the IBM PC that determines the composition of the 7-bit strings of zeros and ones representing each character (alphabetic, numeric and special).

Bisync Bisynchronous Communications. Also abbreviated as BSC, this protocol is one of the two commonly used methods of encoding data for transmission between devices in computer systems. Data characters are gathered in a package called a frame that is marked by two (bi) synchronisation bits. The more modern protocol is SDLC.

CICS Customer Information Control System. This software from IBM runs on the mainframe and makes a variety of services available for application programs. It furnishes easy ways for programs to enter and request data in mainframe files.

Cluster Controller A computer that sits between a group of terminals and the mainframe, gathering messages and clustering them for more efficient transmission to the mainframe.

DISOSS Distributed Office Supported System. An integrated package of electronic mail and document preparation programs from IBM, designed for IBM mainframe computer systems.

EBCDIC Extended Binary Coded Decimal Interchange Code. The data alphabet used in all IBM computers except the PC that determines the composition of the 8-bit string of zeros and ones representing each character (alphabetic, numeric and special).

FEP Front-End Processor. A computer that sits between groups of cluster controllers and the mainframe, concentrating signals before they are transmitted to the mainframe.

Gateway A shared portal from a local area network into a larger information resource such as a large packet-switched information network or a mainframe computer.

INDSFILE A mainframe editing utility commonly used to make PC-to-mainframe file transfers.

LU A Logical Unit in an SNA network that addresses and interacts with the host. Typically in a LAN gateway system, an LU is analogous to a session, a terminal-to-mainframe connection.

NCP Network Control Program. This special IBM software runs in the front-end processor and works with VTAM to link the host computer and terminal controllers.

PU A Physical Unit in an SNA network, usually a terminal or printer, connected to the controller.

RJE Remote Job Entry. A method of submitting work to a mainframe in a batch format. Though superseded by the 3270 system, it is still widely used in some installations.

RU Request Unit or Response Unit. A message that makes a request or responds to a request during a session.

SDLC Synchronous Data Link Control. An essential part of SNA, SDLC is a more efficient method than the older bisync protocol when it comes to packaging data for transmission between computers. Packets of data are sent over the line without the overhead created by synchronisation and other padding bits.

Session The name for the connection between the PC emulating a mainframe terminal and the mainframe itself when they are communicating. The number of sessions that can be run simultaneously through a LAN gateway is limited by the gateway's software and the hardware configuration.

SNA Systems Network Architecture. IBM's scheme for connecting its computerised products so that they can communicate and/or share data.

3174 A new version of the 3274 terminal cluster controller.

3270 The generic name for the family of interoperable IBM system components — terminals, printers, terminal cluster controllers and mainframe front-end processors — that can be used to communicate with a mainframe using the SNA protocol. All of these components have four-number names, some of which begin with the digits 327.

3274/6 The most commonly used cluster controller. This device links as many as thirty-two 3270-type terminals and printers to a mainframe front-end processor.

3278 The most commonly used terminal in the 3270 family. It features a monochrome display and offers a limited graphics set.

3279 A colour terminal that's part of the 3270 family.

3287 The current series of printers in the 3270 equipment family.

3705 A commonly used front-end processor, for linking several 3274s to a mainframe.

3725 A commonly used front-end processor, intended for linking groups of cluster controllers to the mainframe.

3745 A new communications controller that combines the functions of a cluster controller and a front-end processor. The 3745 can interface simultaneously with as many as eight Token-Ring networks, 512 terminals/printers and 16 1.544Mbit-per-second communications lines.

VTAM Virtual Telecommunications Access Method. This software runs on the host mainframe computer and works with the Network Control Program to establish communications between the host and the cluster controllers. Among other things, VTAM sets the pacing and LU characteristics.

X.25 A CCITT standard that describes how data is handled in a packet-switched network.

The VINES 3270 PC terminal emulation software allows each PC to conduct four simultaneous sessions. One session is usually LU3 (the logical unit classification used and the way that the LU is identified by the controller it's connected to; see the glossary), which lets the mainframe control a printer attached to the PC. The terminal emulation software can emulate a 3279 Model 2b with extended attributes and colour graphics.

PCs on the Banyan network need a lot of RAM. After our 512k-RAM XTs loaded DOS, the Banyan VINES networking software, and the 3270 terminal emulator configured for four LUs, DOS's CHKDSK showed about 238k of RAM free.

Banyan's terminal emulation software occupies nearly 100k of RAM; however, if you load it last, you can issue the command REL3270 to free this memory when you no longer require terminal emulation.

VINES 3.0 performed very well in the LAN Gateway performance tests. It didn't top Novell's NetWare running on the IBM Token-Ring Network adaptor cards or the Wyse 10MHz 80286-based server for the LAN tests, but it came close.

Organisations with a strong PC orientation will be comfortable with Banyan's VINES 3.0 running on the Banyan Corporate Network Server. The software is powerful and easy to use. The hardware is a veritable Mack truck, but its AT card slots and built-in I/O ports make it familiar and comfortable equipment. Best of all, its extensive options give it the flexibility many organisations need in an expanding communications environment.

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Xerox has just released its new Ventura Publisher 2.0 range, a range which marks the beginning of the all-electronic era in desktop publishing.

The Xerox Ventura Publisher family will shortly comprise the improved Xerox Ventura Publisher 2.0 base software, the Xerox Ventura Publisher 2.0 Professional Extension, a companion product for much larger documents, and the Xerox Ventura Publisher 2.0 Network Server software.
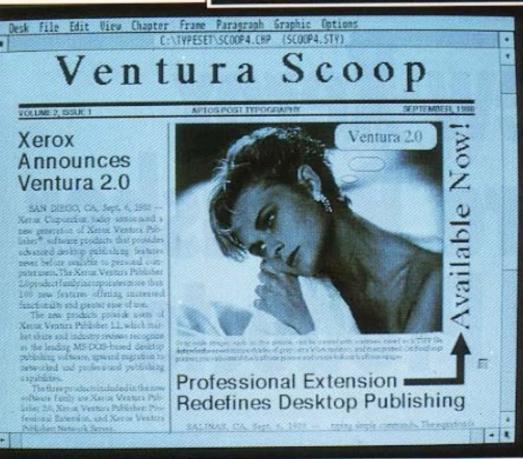
These three products are designed for large corporations, and smaller businesses and publishing houses that require output of a broader array of documents. As well, they put sophisticated document creation capabilities into the hands of the small user. They are, in fact, already in use at a number of Australia's leading publishing houses, including Australian Consolidated Press.

Ventura Publisher 2.0 Base Product: User Friendly DTP

The Xerox Ventura Publisher 2.0 base product makes desktop publishing much easier, since it incorporates more than 70 new features. Now, virtually

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Ventura Scoop

VOLUME 2, ISSUE 1 APTOS POST TYPOGRAPHY SEPTEMBER, 1988

Xerox Announces Ventura 2.0

SAN DIEGO, CA, Sept. 6, 1988 — Xerox Corporation today announced a new generation of Xerox Ventura Publisher® software products that provides advanced desktop publishing features never before available to personal computer users. The Xerox Ventura Publisher 2.0 product family is important to more than 100 new features offering increased functionality and greater ease of use.

The new products provide users of Xerox Ventura Publisher 1.1, which market share and industry reviews recognize as the leading MS-DOS-based desktop publishing software, upward migration to networked and professional publishing capabilities.

The three products included in the new software family are Xerox Ventura Publisher 2.0, Xerox Ventura Publisher Professional Extension, and Xerox Ventura Publisher Network Server.

Ventura 2.0 — Available Now!

Professional Extension Redefines Desktop Publishing

SALINAS, CA, Sept. 6, 1988 — ...using simple commands. The equation is

Now Ventura 2.0 has the ability to read TIFF scanned images, so you can make the most of high resolution photographs

Ventura 2.0 features a more logical menu layout and convenient drop down menus

Less dialogue box clutter on Ventura 2.0 makes DTP more user friendly

anyone can produce better looking documents.

Users will notice immediately that the Ventura Publisher 2.0 is even easier to learn and use than previous versions of Ventura. It features a more logical menu layout, with far less dialogue box clutter.

Now, only the current selection appears for most options, and the list of other selections is in a pop-up menu. There are even several new keyboard shortcuts.

More than 250 context-sensitive help screens are available within any dialogue box. They make document production far easier, and they speed up the learning process. They also make the Ventura 2.0 more "User Friendly" than any previous version of Ventura Publisher.

All tag modifications are now in one menu option. Users can select drop-down or pull-down menus.

What is special about Ventura is that it now enables the user to fully exploit the power of his/her computer. A library of style sheets provides professional layouts instantly, and enables the user to

start producing better looking documents right away.

This unique, highly automated style sheet system, with newly streamlined commands, enables one to easily create and maintain a professional look for all documents.
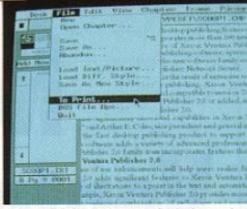
Ventura 2.0 automatically uses a chapter name to create a text file of the same name, eliminating the need to remember two separate names. It also automatically inserts page and chapter numbers wherever on a page the user specifies, and will automatically create an index.

After any revisions, etc., the text is re-formatted automatically.
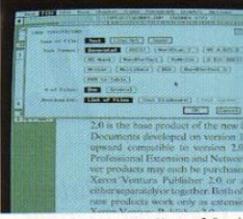
Improved Typography

There are a number of major improvements to Ventura's typography in version 2.0. These include:

■ **Type sizing in half-point increments,** from 1 to 254 points, any printer that supports scalable fonts (eg., PostScript and Interpress). The user can bump the type size up or down in one-point jumps over a selected range of text

with a keystroke.

■ **Rotated type,** in 90-degree increments. Since there is no longer a "right margin" when type is rotated, Ventura lets the user specify the height to which it will be set.

■ **Automatic pair kerning,** if pairs are defined for the font being used. Since kerning slows the program, Ventura gives you the option to disable kerning either by turning it off altogether or by enabling it only above a user-set minimum point size.

■ **Manual white-space adjustment.** Users can select a range of text and tighten or loosen the spacing of the letters in hundredths of an em. It is most often used to improve the appearance of banner headlines by compensation for a well-known optical illusion: large type looks loose if it is spaced in the same proportion as small type. But it can also be used to fix loose lines. By forcing an earlier line to be set looser or tighter, the user can cause a change in the ending of that line and, therefore, in future lines as well.

■ **Automatic generation of fractions.** Even without the full maths package
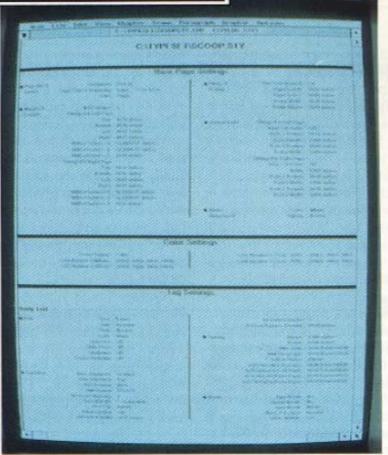
Each dialogue box now features a special 'help' button

Clicking the 'help' button provides you with the relevant choices from more than 250 context-sensitive help screens

Simply select the type of help you need and the required solution is provided on the screen

Ventura 2.0 has a unique, highly automated set of style sheets to give your documents exactly the look you want

that is part of the Professional Extension (discussed later), Ventura 2.0 supports easy generation of fractions. There are two styles: case fractions like 17/22, (suitable for stock market quotes and disk dimensions), and drawn fractions like x/y, (used in maths). With the latter, users must be careful about line spacing.

■ **Typesetter line leading.** Most desktop publishing programs "hang" the first line of type from the top of the frame border. In typesetting systems, on the other hand, the type rises from a baseline whose spacing from the top of the frame is given by the inter-line leading. The difference affects the alignment of type across columns if varying type sizes are used. Ventura now gives you the choice.

■ **Automatic expansion of line spacing** to accommodate larger fonts in the middle of a paragraph. This is especially useful in conjunction with maths fractions, which generally take up twice the room of straight text. This option is set on a tag-by-tag basis, so users can disable it for normal text styles but allow it in paragraphs tagged for maths.

■ **Automatic conversions to quotes** (" ") from inch-marks (") and to em-dashes (—) from multiple hypens (--). Though the better word processors allow true open-and-close-quotes, most typists have the habit of using inch-marks, and Ventura now compensates for this.

■ **Position and size** of subscripts and superscripts and the size of small capitals can now be specified for each tag. One can also set the thickness and position of underscore, overscore and strike-through lines.

■ **Decimal tabs now work even when there is no decimal point.** This is important in setting financial tables, where negative numbers are often shown in parentheses. Ventura aligns the numbers on the rightmost digit if there is no decimal point, so that the right parenthesis hangs into the margin. A very professional touch.

In addition, users can now set up decimal alignment without using tabs. Decimal alignment takes its place in the tag definition alongside ragged and justified setting of body copy.

Also, one can set leaders that fill out the line without going into tabs.

Horizontal Justification

Another improvement is the method of justifying lines.

In version 2.0, Ventura has adopted a more sophisticated approach for the algorithm that gives preference to spaces over hyphenation.

There are now two things that can be done about a loose line. One can insert a discretionary hyphen (perhaps forbid the program from breaking a word earlier in the text) or adjust the spacing on an earlier line.

Overall, Ventura now gives nearly all the tools to produce high-quality typography.

Pagination

A major improvement in Ventura 2.0 is that users can now set chapter-wide default paramaters for several pagination properties: column balancing, window/orphan controls, and leading of the first line of a column. It is possible to then override these defaults for any individual frame, while still retaining the option to return later to the chapter-

wide parameters even if those have changed in the meantime.

Page and chapter numbers can now be inserted anywhere, not just in the headers and footers. Combined with the repeating frame feature, users can, for instance, place a page number in the side margin or in text paragraphs.

In addition, users can now show or hide pictures selectively, on a frame-by-frame basis. Also, hidden pictures will not print unless you specify that they should in the print dialogue. This lets you print draft copies much faster.

Anchors

Ventura's anchored frames guarantee that a table or photo will appear close to the text that discusses it, no matter how radically the text is reorganised during editing. This function has now been extended for Ventura 2.0 so that if there is not enough room for an anchored frame on the current page, the program will push it to the top of the next page and back-fill the current page with text from following paragraphs.

Graphics

Recently, Xerox released a set of patch disks for Ventura Publisher de-

signed to let it work within the Microsoft Windows environment. Part of the update included the ability to import Windows graphic metafiles. This is a standard feature of version 2.0.

Ventura 2.0 also has the ability to read TIFF scanned images, and also the ability to control the screen frequency and angle used in printing the grey-scaled information on PostScript printers. The manual includes a helpful discussion of the half toning process and the way it interacts with your scanner settings.

Ventura could read Encapsulated PostScript files in Version 1.1, but couldn't display the image on the screen. Now there are some graphics programs in the market that place a Windows metafile or a TIFF image in the screen part of their EPS files. If it finds a metafile or TIFF screen image in the EPS file, Ventura 2.0 will display that on screen.

On non-PostScript printers, Ventura will do its best with a frame containing an EPS graphic. The PostScript half of the file obviously can't be used, but if there is a Windows metafile or TIFF image in the screen representation half, Ventura will send that to the printer.

Enhanced Colour
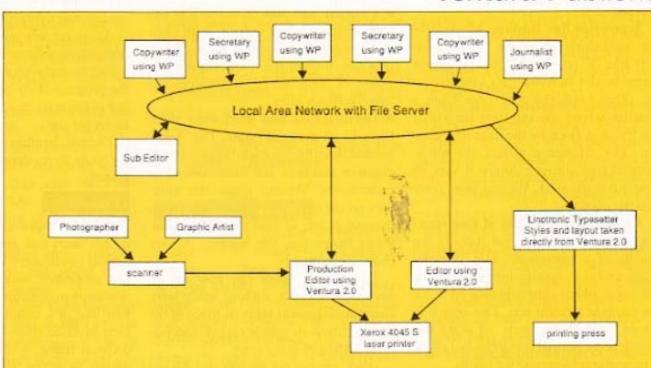
Ventura 2.0 also has introduced colour controls for preparing and printing colour separations so users can more easily prepare the separations from their document files. It is now possible to specify colour PostScript printers or create separations on any black and white printer. Grey scale image controls lets users make the most of high resolution photographs.

Version 2.0 lets users specify the shade of each system colour as a percentage of cyan, magenta, yellow and black (CMYK). It is possible to redefine any of the eight colours to any mixture you like. On a VGA colour monitor you can see a good representation of the effect. And colour PostScript printers can print the file in colour.

Users can also define that eight system colours to be any 500 different shades of grey by turning off the three primary colours and working only with the black control. VGA monitors can show the result quite well; but if your monitor can't do grey scaling, the system will use fill patterns.
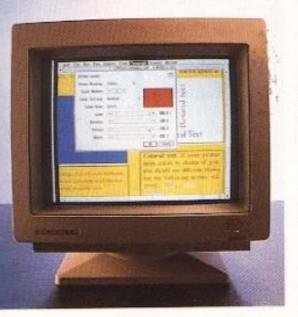
As a practical matter, most users will

Ventura Publisher

Producing A Major Document Using Xerox Ventura Publisher 2.0 With The Network Server

Controls

With the colour pallete in Ventura 2.0 you can create any colour you want by mixing cyan, magenta, yellow and black

get more benefit from the grey-level controls (which can be reproduced on low-cost equipment) than from fancy colour. While greyscaling is widely available in Macintosh software, very few PC programs offer it.

2.0 Network Server

Where more than one person contributes to the writing, editing, graphics or layout of a desktop published product, the Ventura Publisher 2.0 Network Server allows them to share a centralised version of 2.0. They can then eliminate redundant files, reduce storage requirements and work together on the same document.

One user at a time can access Ventura Publisher. Each additional base product logged into the server software adds another simultaneous user. The software assures that only one user can edit a document at one time.

This software can also manage multiple workstation configurations, the Network Server supporting 3Com, Novell and PC NET local area networks. Other networks can be supported by writing custom-loadable network modules.

Ventura Publisher 2.0 Professional Extension: Big Document Publishing

The 2.0 Professional Extension takes DTP users into the big league. For example, it incorporates EMS (Expanded Memory Support), for larger documents like books and technical manuals. In addition, automatic vertical justification will fill a given space with text, a feature not previously available in desktop publishing.

EMS Memory Support

If your computer has expanded memory, Ventura Professional Extension can take good advantage of it to handle longer and more complex documents. Users don't even have to do anything special to invoke this.

Ventura's base product uses expanded memory to store program code segments, avoiding the delays in fetching segments from the disk. The Extension adds the ability to put document data there.

Dictionary Hyphenation

With at least 1.2Mb of EMS memory (and an equal amount of spare disk space), users can install the Edco 130,000-word hyphenation dictionary. Since the dictionary is in RAM, it does not materially slow down the loading of text files. (N + Ventura inserts all possible hyphenation points into the text during the initial loading, so that the program does not have to waste time looking them up or computing them.)

And users still have the alternative of using the Ventura algorithm by setting a switch, which one might do when reprinting an old document.

If a word is not in the dictionary, the program will try to break it using Edco's prefix and suffix tables.

Dictionary Maintenance

Users can also add words to and delete them from the Edco dictionary, although not from within Ventura Publisher. Your favourite text editor can be used to make a file of the additions, changes and deletions needed, then a

stand-alone utility program can be r in order to install the updates in t main dictionary file. The next time t dictionary is loaded, the changes w take effect.

Xerox also supplies an Edco utility examine all hyphenation points in a word. This will be of only academ interest to the average user, but profe sionals will find it handy at times.

Ventura, like most advanced p grams, lets users control the minim length of a word that will be hyphe ated, along with the minimum numb of letters before and after the hyphen

Cross-References

Users can create cross-references the pages, sections, tables, figures, c tions and chapters of a document. V tura will automatically update the whenever the document underg multi-chapter renumbering. Setting cross-reference is straight-forwa place a marker (similar to a frame chor) at the location one wants to re to, then place the cursor where cross-reference is required to app and choose 'Insert Special Item.' A logue box will pop up, allowing the u to set up the necessary parameters.

Variable Text

A special feature of the Professio Extension is its ability to define va bles and use them throughout the te When a variable is changed in the d nition, all references to it are autom cally updated. Uses include printing manual for a product whose name ha been finalised, and placing the curr date.

You can have many different va bles in a document, and they can all updated in one operation. They can be updated across multiple chapters a single operation.

This is actually a variation of cross-referencing features, and lik cross-reference, the update only ta place when you renumber the chapte

Vertical Justification

Many publication styles require that all columns exactly fill their allotted space, even if the text runs a little short.

The professional Extension adds functions that let the computer stretch out the text to fill the space. In general, the objective is to place extra space as unobtrusively as possible.

There are three places Ventura can do this:

■ **Around frames.** This is the first place Ventura looks to place extra space. A frame can be declared as either fixed or movable; if it is fixed, Ventura will add space below it, while if it is movable, Ventura will slide the frame down to put space above and below.

■ **Carding.** The next place Ventura looks to put extra space is between paragraphs. Each paragraph tag can have different limits for the amount of carding, so you can restrict it to just around heads.
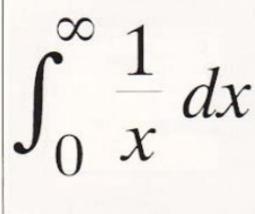
■ **Feathering.** Ventura will try spreading out all lines equally. This is separately controlled by the tag for each paragraph. Users can set the amount of extra space that will be permitted in each option, or turn off any option entirely.

The last page of a chapter is usually permitted to print short. Ventura lets you specify the maximum amount of Vertical Justification spacing that will be added to any page; if the page would still print short, then no extra space is added.

Maths
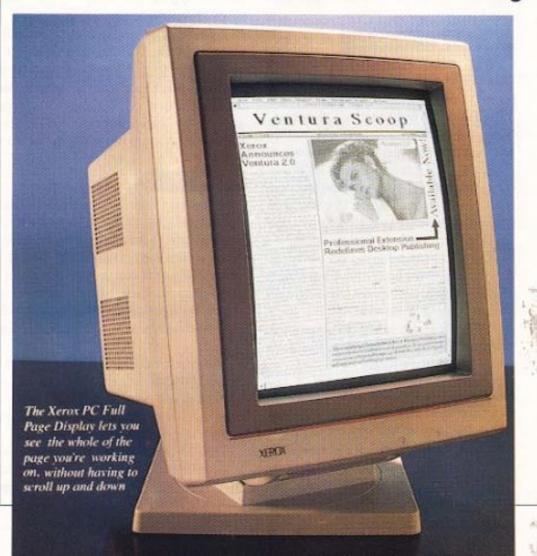
The Professional Extension includes multi-level maths setting package.

To place a formula on the page, users need only issue two commands (or menu picks) to open an equations-editing window. At the top of the window,

int sub 0 sup inf {^1 over x^dx}

$$\int_0^\infty \frac{1}{x}\,dx$$

The Professional Extension allows you to create complex mathematical equations

Business Publishing

The Xerox PC Full Page Display lets you see the whole of the page you're working on, without having to scroll up and down

Every business produces documents, whether for internal or external use, and every document produced is important. It's a reflection of you and your business.

And the Xerox range of equipment can provide you with the total Desktop Publishing solution.

The Xerox PC Full-Page Display

The Xerox PC Full-Page Display lets users see the whole page when writing and editing or preparing a layout. So work gets done faster and more accurately than ever. And it saves time by reducing layout errors normally only discovered after printing.

With the Xerox PC Full-Page Display, users can work on a complete A4 page without scrolling up and down. It saves time and also makes for better results: to merge text and graphics and get the right page balance, the whole page must be visible at a glance.

The Xerox screen also features reverse video. Operators can choose the format (black-on-white, or white-on-black) that's easiest on the eyes during long working sessions. It also swivels and tilts for convenience and comfort.

one enters the text of the maths commands. Whenever typing is halted for a few seconds, the computer draws the result below the commands, so the user can see whether it is right. When one exits from the equation editor, the formula is pasted into the chapter as a single object. Users can't edit the object directly, but can invoke the equation editor again to make the changes.

As with all other Ventura text markup functions, when one writes the text out to a word processor, the maths appears as a string of text with command delimiters. It is the same as the text typed into the maths editing window to create the formula originally. In a production environment, with users who are familiar with the commands, this allows rapid entry of at least the major features of the equation, leaving only minor details to be touched up in Ventura's maths editor.

Table Editor

Another feature of Professional Extension is that it is designed for laying out complex tables.

■ **Tables can be set up for a large number of columns and rows,** limited only by the PC's memory capacity. If the user changes his mind later, he can readily insert or delete rows and columns just the way he would in a spreadsheet program.

■ **The columns can be individually set to any width,** by command or by dragging with the mouse. By command, users can set column width either to a fixed value or as a proportion to all other columns; and can mix these two modes in a table. Row height automatically expands to accommodate the largest text in any cell of the row.

■ **Users can join any group of cells together.** This gives straddle heads

(heads that straddle several column and tall cells that span multiple row Users can later undo this, splitting cel that have been joined.

■ **Users can specify how many row are to be considered table headers.** one allows a large table to break acros column boundaries, Ventura will repe the headers at the top of every ne column.

The Professional Extension is th perfect companion for the Ventura 2 base product, and is especially attractiv to users in demanding publishing env ronments. Users such as scientists, i surance firms, engineers and databa publishing houses, who deal regular with mathematical equations, cross re erences and large complex tables of da will especially appreciate how th Professional Extension makes these tr ditionally difficult tasks far easier handle.

The 4045 S-Printer: Fast, Quality Document Printing

The 4045 S-Printer is the only printer that can print everything users can produce on Xerox Ventura 2.0 from 254pt fonts to reverse text. It also does this at a speed of under 30 seconds per page.

The S-Printer has an Outline Driver
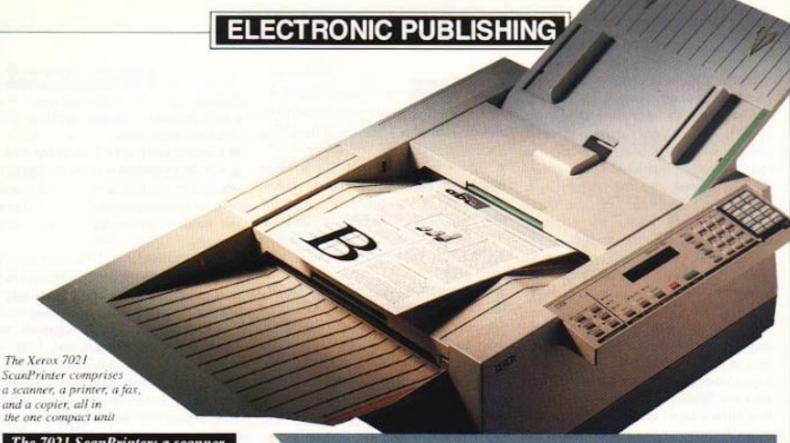
that automatically generates fonts in any size, up to 1000 point. Users have the flexibility of choosing from 35 different typefaces in any point size without taking up large amounts of disk space. The 4045 also eliminates those jagged edges that occur with some laser printers which simply enlarge the dots per inch. Instead the Xerox laser printer generates

the character in 524 point and th reduces down to the size required. T result is fine definition.

A resolution of 300 x 300 dots p inch gives documents the finished lo of typeset quality publications.

And the S-Printer will handle a lar output, up to 10,000 pages per mont with ease.

The Xerox 4045 S-Printer
prints anything that can be produced
on Ventura from 254 point fonts to reverse text.
And all in under 30 seconds per page

The Xerox 7021 ScanPrinter comprises a scanner, a printer, a fax, and a copier, all in the one compact unit

The 7021 ScanPrinter: a scanner that will also print, send fax messages and copy

This one small unit offers each of these facilities, or all four.

A scanner – the ScanPrinter can be first used to scan an image – Line art or photograph – and then directly into a Ventura publisher document on your IBM or MS/DOS compatible PC.

A printer – print the document straight back out on the ScanPrinter from your PC (this takes only 2 minutes).

A facsimile machine – users can then choose the facsimile function on a Ventura Publisher programme and send the document direct from the screen to any other compatible fax machine – regardless of location.

By using this Ventura communications link, users can also create their own mailing list and fax documents direct from the screen to a number of places with just one command.

A personal copier – use it for convenience copies, too.

Or course, any of these functions can be used independently.

But when used all together, as a scanner, a printer, a fax machine and a copier, then the applications are greatly multiplied. Quite simply, it is a cost effective and space efficient unit that will make your working day easier.

The Xerox 4020 Colour Ink Jet Printer offers advanced printing in 7 distinct colours, which can be mixed to give up to 4,000 shades

The Xerox 4020 Colour Ink Jet Printer: Add Life's Colour To Black and White Pages

The 4020 Colour Printer brings a pallette of vivid colours to ordinary graphics.

The 4020 Colour Printer offers seven distinct colours – Black, Cyan, Magenta, Yellow, Violet, Green and Red – using advanced 20-nozzle drop-on-demand ink jet technology.

Best of all, you can mix these colours for up to 4000 shades, from the most powerful reds to the softest pastels.

Use these colours to draw the finest lines for technical drafting. Colour text and headlines for desktop publishing. Fill blocks for pie charts and graphs. And even produce complex multi-colour graphics. All in the one page, printing straight on to transparencies or paper.

And the 4020 is compatible with most popular software packages developed for the IBM PC and compatibles.
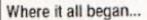
The 4020 Colour Printer is highly affordable, making it one of the best printing values today. And because of its unique self-cleaning vacuum action the 4020 is almost maintenance-free.

TOSHIBA

Computer Products Division

Past
Present
& Beyond

Where it all began...

The Computer Industry today is the world's largest income earner but its history is not much older than the average age of the people who work in it.

In just over 40 years computer technology has progressed from where a 64K capacity computer engulfed an entire room in the 1950's to today's super laptops like the new fast TOSHIBA T5200, 80386 which weighs 8.6kgs, offers a 100Mb hard disk drive and memory capacity of 8Mb of random access memory (RAM).

Many of the companies who have put computing at the heights it is today have a history which began in the 1970's with many not yet 10 years old.

Unlike many of these companies, whose start was created from existing tech-

nologies, TOSHIBA was there at the beginning, in fact 70 years before the first computer was designed.

In that time TOSHIBA has encountered and mastered numerous challenges, including those presented by constant changes in the world's economy.

TOSHIBA began in 1875 as a manufacturer of communication equipment for the infant, but rapidly expanding wireless and telegraph industry.

Thomas Edison inspired TOSHIBA

As with any rapidly growing company, it soon looked for new products to produce. This led to the production by the company of incandescent light globes following their invention by Thomas Edison in the USA.

From humble beginnings in a single factory on 80 square metres of land at Shimbashi, Tokyo, Japan, TOSHIBA then known as the Shibaura Seisakusho Works, has grown to be the sixth largest company in Japan, 43rd largest in the world, employing over 125,000 people in 54 Sales and Marketing Companies in 27 different countries around the world.
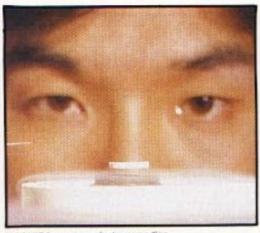
TOSHIBA Corporation is one of the world's leading high technology companies with international sales revenue of 3570 billion Yen in 1987/88 ($36 billion Australian).

TOSHIBA is far from just a leading Japanese Company but a leading global enterprise with global responsibilities.
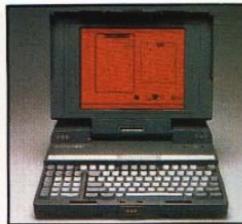
In response to the unprecedented changes occurring in business and society the world over, TOSHIBA is

The "Bullet Train" - TOSHIBA Technology.

TOSHIBA superconductor expertise.

T5200 - 100Mg, 80386 laptop power.

pursuing a long term Corporate strategy based on E & E, Electronics and Energy.

TOSHIBA defines "Electronics" as what helps to create, store and control the vast amounts of information associated with the evolution of a highly advanced information society while "Energy", is what provides the essential foundation from which tomorrow's societies will be powered both at the industrial and community levels.

Its diversity in the electronics and energy fields mean that few people's lives are not directly affected by TOSHIBA's technological advances. For example, one third of Australia's electric power is generated on TOSHIBA generators. TOSHIBA creates electricity via the construction of power stations, transformers and cabling like that in the giant Bayswater and Tumut III constructions in New South Wales.

It designs and builds transport systems, like the famous $178 million "Bullet Train", escalators and elevators to get workers to their offices; it makes buildings, the furnishings inside them and all the computer hardware and software needed to support it.

TOSHIBA has a huge range of photocopiers, facsimile machines and intelligent telephones which can accept video links. It also makes television studios, ground stations and communication satellites for international links.

TOSHIBA is the top producer of medical electronic equipment in Japan and its product range is at the forefront of diagnosis and treatment. They make CT (Computer Scanners) for the brain and body, ultrasound diagnostic equipment, automatic chemical analysers and patient monitoring equipment.

TOSHIBA's name in the past has been most visible in the home, enriching the lives of countless millions. In the consumer area they market microwave ovens, airconditioners (both commercial and domestic), washing machines, refrigerators, television sets, VCR's, compact disc players, portable audio and hi-fi equipment. In electron tubes, TOSHIBA is a world leader having been the first in Japan to develop a colour picture tube and have stayed at the top of the electron industry and acquired new technologies since that time.

Its diversity in the electronics and energy fields mean that few people's lives are not directly affected by TOSHIBA'S technological advances.

TOSHIBA in Australia

TOSHIBA began operations in Australia on November 1, 1975, in a joint 50-50 enterprise with the British Company, E.M.I. This partnership was dissolved when E.M.I. withdrew from consumer electronics worldwide in 1978 and TOSHIBA continued its Australian operation alone.

Today it employs over 300 people, enjoys sales in excess of $200 million and has offices in all capital cities of Australia and New Zealand.

TOSHIBA (Australia) Pty Ltd comprises four product divisions, Computer, Copier/Facsimile, Consumer and Medical.

Computer Products Division which was established in 1980 has grown by over 100 percent in the last three years and now employs over 60 people.

Selling exclusively through a network of over 210 authorised dealers in Australia and New Zealand, the TOSHIBA Computer Products Division (CPD) markets 2 laser and 3 dot matric printers, 11 high capacity hard disk drives and the world's most comprehensive range of 10 battery and mains powered laptop computers.

CPD TODAY

1988 has been a record year for CPD in Australia.
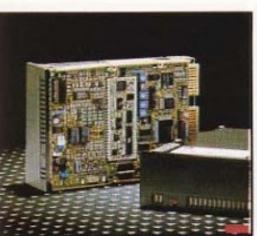
Of all sectors of TOSHIBA Computer Products around the world, Australia is the most successful per capita, earning equivalent of $1 million per employee of the Division a record few Australian computer companies can match.

Excluding Northern Territory and Tasmania, CPD have established offices in all Australian States, as well as Auckland and most recently Wellington in New Zealand.

During 1988 CPD won every major Government tender it chased including PE30, the Federal Government's Small Systems Contract.

In line with rapid expansion into large business, CPD have established a Corporate Division to assist dealers in this area.

As a distribution marketer, it does not sell direct to the public because it believes with 210 dealers, employing over 1500 specialist staff between them they

Seven hard disk drive models.

Sponsors of the Royal Flying Doctor.

Invented 24 pin dot matrix printer technology.

can provide a much better and more direct and personalised service to customers.

Although TOSHIBA's dealers are in the front lines when it comes to end users, CPD provides an extensive support program through its dealer technical support hotline and Honeywell Service Centres located throughout Australia and New Zealand.

CPD this year introduced the TOSHIBA Education Plan (TEP) in Australia. The plan allows all students, teachers and lecturers to purchase low end TOSHIBA laptop and printer products at very attractive prices.

TOSHIBA has always believed in a small but specialised group of dealers...

Students are able to make enquiries on TEP through selected TOSHIBA education dealers located in each State or their regional TOSHIBA office.

At major presentations in all States in February 1989, TOSHIBA will position its products for the year and also launch some exciting new printers into the marketplace.

Notable firsts in 1988

The opening of the TOSHIBA office in Auckland in May and more recently Wellington has reinforced the companies decision to support its small but dedicated dealer network in that country. New Zealand like Australia is a rapidly expanding market for TOSHIBA.

TOSHIBA has always believed in a small but specialised group of dealers to avoid the supermarket effect of just selling boxes. The company's support of its dealer network was reflected during the year by a dealer's satisfaction survey conducted by Compass Research in dealers rated TOSHIBA No.1 in printers and number three in PCs in Australia.

Incentive competitions among dealer sales personnel, which this year included the winning of a Honda CRX Sports Coupe and other major prizes were well received and will be expanded in 1989. All incentive schemes will culminate in the staging of TOSHIBA's first major National Sales Achievers Conference at the award winning Sheraton Mirage Resort at Port Douglas in Queensland in May 1989.

In 1988 TOSHIBA Australia embarked on a widespread R & D program with Australian based companies. Successful projects like the new PageLaser 12 Twinax released in December with its IBM System 34/36/38 & AS/400 interface and worldwide market potential is a good example of TOSHIBA's future R & D direction. Other areas being researched include Software Development, Turbo Communications and high speed internal modems.

Flying Doctor sponsorship

TOSHIBA's policy of close association with the countries they operate from has no better example in Australia than this year's $100,000 sponsorship by the company of the Royal Flying Doctor Service Association.

The 14 laptop computers and a PageLaser 12 laser printer presented will be used by Flying Doctor personnel at the association's outback regional centres located throughout inland Australia.

Only sells laptop PCs

Although TOSHIBA only markets laptops in Australia it is the sixth largest supplier of PCs to the Australian marketplace.

With ten different models available on the Australian and New Zealand market at present, whcih are all leaders in their class, TOSHIBA's growth in PC rankings in 1989 are expected to be substantial.

Second only to the United States, Australia has the largest sales of printers for TOSHIBA in the world. The rapid growth of 24 pin dot matrix sales in 1988, projected growth for 1989 and dramatic expansion in Australia and New Zealand of the PageLaser 12 and new PageLaser 12 Twinax will push TOSHIBA's printer sales to new heights in 1989.

Product knowledge

TOSHIBA Australia will continue to broaden the product knowledge, training and technical expertise of its key staff by sending at least two people to Japan each month.

At the same time Australia receives regular visits from senior ranking staff from all product areas of TOSHIBA Japan who provide the latest R & D information on the expanding TOSHIBA range.

Second only to the United States, Australia has the largest sales of printers for TOSHIBA in the world.

Tomorrow's technology today

TOSHIBA around the world believes in a comprehensive R & D approach, aimed

PageLaser 12 Twinax.

TOSHIBA Education Purchase Plan.

T1600 - battery powered backlit 286.

at exploring the technological frontiers of tomorrow.

Supporting this policy, TOSHIBA in the 1988/89 fiscal year, will employ over 20,500 research engineers and invest over $2 billion in Research and Development.

TOSHIBA is the world leader in the production of 1-megabyte dynamic random access memory (DRAM) chips, the most advanced chip produced so far. Production of 4Mb chips will commence in 1989 while research and production of 64Mb chips is well advanced.

In semiconductors production, an area recognised as the building blocks of tomorrow's technology and products, TOSHIBA is a front runner.

TOSHIBA is also at the forefront of production of superconductors which will totally revolutionise the world beyond the 21st Century. This technology will allow the production of smaller and cheaper super computers, increasing their availability and the number of products that will utilize computer technology.

TOSHIBA have developed erasable optical memory disks and the first Japanese language word processor which combines not just 26 letters but thousands of different characters.

They are developing perpendicular recording technology so that the 3.5" inch disk can store 4Mb of data.

High technology services and software businesses are also supported by TOSHIBA's leading edge technological capabilities.

One example is the TOSHIBA Super Smart Identification Card (IC) developed jointly with VISA International. A world's first, this multifunction IC Card will usher in a new generation of IC technology. The card offers a display, input capabilities and 100 times the capacity of the present magnetic cards.

The development of advanced IC Card systems will usher in a new card society in the year 2000.

Its expertise in the construction of assembly robots and other factory automation products are other examples of TOSHIBA's devotion to its Electronics and Energy strategy.

High level technological innovations rely a great deal on the development of highly reliable materials. Here TOSHIBA and its group companies are supplying an extensive range of industrial materials including high tech metals, such as amorphous alloys, fine ceramics and various chemical products.

As the world moves towards the high advanced information society of tomorrow, endless opportunities are being created in the business of information processing and telecommunications.

TOSHIBA continues to reinforce its commitment to the laptop market with no less than 17 different models under development at any one time.

As has been shown in the past TOSHIBA can and does respond quickly to market demand, by continually bringing leading edge products to the marketplace.

TOSHIBA's wide experience and knowledge in the production of bright backlit colour liquid crystal display (LCD) screens will soon see this technology appear in TOSHIBA laptop PCs.

TOSHIBA erasable optical memory disks.

Leaders in 1Mg DRAM chips

Coloured backlit screens technology.

OKI
Past, Present and Future.

In the coming months, Australia is set to experience a quiet revolution, as the Japanese communications giant OKI Electric, brings its operation to our shores.

The company has appointed Mr. Tetsuhei Kawamura as the General Manager of its Sydney based Australian Representative Office, which was officially opened on December 8. As Mr. Kawamura says, "OKI is committed to its future in Australia".

OKI is already a familiar name to Australian PC users, of course, due to the success of its high-quality dot matrix and laser printers. What is less well known, is the size and scope of OKI's activities world-wide.

Founded in January 1881, the OKI Electric Industry Company has grown into a multi-national company and one of the largest high-technology concerns in Japan. Currently employing around 18,600 people, it is part of a powerful group which includes Nissan and the Fuji Bank. In 1987, the company reported Net Sales of 451,54 million Yen.

But how does OKI achieve such impressive results? The answer is diversity. The company is currently divided into three product groups: Telecommunications Systems; Information Processing Systems and Electronic Devices. Within those categories lies a world of innovation, with products ranging from digital PABXs to underwater acoustic sensors.

Australia has already experienced some of this innovation, of course, although much of it has not been directly associated with OKI. Racal Electronics' cellular mobile telephones, and GEC Australia's Okifax facsimile machines are familiar and successful products on the Australian market, but few people realise that they are designed and manufactured by OKI Electric.

Diversity is a great strength, of course, but OKI could not have reached its elevated position in the world market without constant product innovation and enhancement. Innovation is still a byword within the company, and each operational group works at the leading edge of its sector.

Take the Switching Systems group, for example. OKI's telecommunications specialists are currently shaping the Integrated Services Digital Network (ISDN) that will link telephones, computers and facsimile machines across the globe. Full scale ISDN services will begin in Japan in the 1990s. ISDN PABXs allow both voice signals and moving colour images to be transmitted simultaneously at 64 kilobits per second. When implemented they will allow people to transmit and receive voice, image and data signals more efficiently than ever before.

OKI has already announced a video-phone device for its INS-Net implementation

of ISDN. Called the Omnimate-10, it displays a video image of the caller on a wafer-thin LCD screen.

Other services will include teleconferencing systems, and the linking of high-technology peripherals such as OKI's D10 multifunctional digital telephone and its OF-1000 series of G4 FAXes. At OKI, the future is a reality.

OKI's other telecommunications products have also found a global acceptance. Since shifting production of the new Oki CDL400 compact cellular phone to Atlanta, Georgia, the product has achieved phenomenal sales in the US, Canada, Australia and New Zealand. A credit card operated version, for use in rented cars, has also notched up impressive sales.

OKI's diverse product range is backed by an extensive component manufacturing facility. In 1988, this section of the company's business was given a significant boost by the huge demand for 1-megabit dynamic access memories (DRAMs). Sales of application-specific integrated circuits (ASICs) also rose substantially. Component manufacture is clearly a major contributor towards OKI's growth, and the company has boosted its ability to meet increasing demand for ultralarge-scale ICs, by constructing an additional IC plant in Miyagi, Japan. The site will be productive by December.

But what of the future? OKI's Electronic Devices unit is already committed to a development program that heralds vast increases in computational power. In fiscal 1988 it will ship a 4-megabit DRAM, and development of a 16-megabit chip is already under way. Even more astounding is the news that OKI is currently undertaking research which will lead to a 64-megabit DRAM. By taking advantage of its research and development, production and marketing resources around the world, OKI is well placed to build on its solid base in the global electronic device industry.

OKI's strength in component manufacture is often the spring-board for its massive R&D effort. Indeed, its concentration on R&D has allowed the company to consolidate its position as a leading manufacturer of telecommunications systems, information processing systems and electronic devices.

A vital part of OKI's research commitment is its participation in national projects which cover leading-edge technologies. These include the Fifth-Generation Computer Project, high-speed-logic and three-dimensional ICs, operation-specific robots, databases that can be accessed by different types of computers and optical and electronic IC devices. Not all of OKI's projects are so esoteric, however. In the information processing systems sector the company has released the innovative OKI-TAC 8300, an integrated office processor, and addressed the need

for more sophisticated office automation equipment by releasing the ifCOM-11 workstation. The ifCOM-11 features a personal computer, a telephone and a communications terminal.

OKI's attention to R&D issues paid off at Telecom '87, held in Geneva Switzerland. The company won critical acclaim for several exhibits, including PENSEE, a Japanese-English machine translation system. PENSEE is capable of automatically scanning hand-written or printed documents with an optical character recognition device. An integrated mobile communications system, incorporating a G3 facsimile machine, also won warm praise.

You can expect even greater technical innovation from OKI in the coming year.

On the PC front, the R&D themes are as diverse as the company itself. OKI's LCD flat screens will become larger, and capable of higher resolutions, and it will continue to work with gas plasma technology. The 640 x 400 resolution gas plasma monitors are widely expected to replace bulky CRTs on everything from workstations to laptop computers. In addition, Artificial Intelligence (AI) will be introduced into systems of all types, and OKI will continue to develop new systems using the LISP and PROLOG languages.

In the telecommunications sector, OKI is developing high-efficiency voice-band compression and image signal compression technologies for office network systems. The component sector, meanwhile, will focus on 16-Mbit dynamic RAMs that harness half-micron processes along with opto-electronic ICs (OEICs).

So much for the future. OKI's current product range is equally exciting with full-featured offerings in all major sectors. Take a look at the PC range, for example. OKI manufactures both 16-bit and 32-bit microcomputers, known as the if800/RX and if800/EX series, respectively. Characteristically innovative, the 32-bit machines are available with OKI's multitask monitor, which was specially developed for use with multi-media communications systems.

Besides PCs, OKI manufactures a range of printers that are distributed in Australia by the Sydney-based IPL-Datron.

OKI's printer range is currently headed up by the Laserline 6 Elite, although the company will shortly announce a new model. This development will prove OKI's continuing exploration of new and exciting avenues in printer design. The Laserline 6 Elite is a special machine. It produces both letter-quality documents, and high-resolution graphics, at resolutions of 300 dpi and a throughput of 6 pages per minute. Those documents can be enhanced with any one of the Laserline's 15 resident fonts, or the 27 typefaces available on optional cartridges.

Others dream of the 21st century at OKI we live in it

When people talk of OKI as a company of the future they mean today.

OKI is in the forefront of the development of the integrated communications systems, that will bind us together throughout the 21st Century.

OKI has leading-edge technological prowess in telecommunications, information processing and electronics which is crucial for building the Integrated Services Digital Network (ISDN), the realisation of which is only just taking shape.

The current range of Laser Computer printers, mobile cellular phones, facsimiles and componentry available in Australia are products of the practical implementation of high technology, which is the hallmark of OKI around the world.

OKI Solving tomorrows problems today

When it comes to paper handling, the Laserline is equally versatile. 150 pages can be stacked in the 'face down' output stacker, which also collates the finished documents. A 550 page input tray is available as an option.

Large documents, and memory-hungry DTP layouts, present many printers with a problem. Not so the Laserline 6 Elite. A 128k buffer is supplied as standard, which can easily be expanded up to 2.5Mbytes. When expanded the printer's memory will store many pages of ultra-high resolution charts and graphs. As you would expect, the Laserline is fully compatible with the Hewlett-Packard LaserJet, and all the software written for it.

If the ultimate quality and flexibility of a laser printer exceeds your requirements, take a look at OKI's dot-matrix range. It's led by the hugely successful Microline 393, which is affectionately known as the "intelligent workhorse".

A unique feature of this 24-pin model is the 'personality module', which protects your printer investment by storing emulation logic in a removable unit. As new emulations become available the module will keep your 393 completely compatible with the latest applications software.

The Microline 393 also offers the last word in typeface flexibility. Resident typefaces in sizes from five to twenty characters per inch can be called up at the touch of a button, and font cartridges are available for even greater versatility.

Although the 393 is capable of a blistering 450cps, its speeds are switchable to match your printing needs. There are four to choose from, ranging from 450cps to Letter Quality at 120cps. At any speed the 393 will impress you with its whisper-quiet operation.

Paper handling options are something you associate with the best printers, so it's no surprise that the Microline 393 is well equipped. A Single Bin Feeder, for example, will continuously feed up to 170 single sheets, and there's a powerful Pull-Tractor for printing cards, labels and other difficult stocks. If you need even greater versatility, simply add the Dual Bin Feeder. The 393 will automatically switch between the two different types of cut paper, such as letterhead and second sheets, at the touch of a button.

Sitting just below the 393 in the OKI dot-matrix range is the Microline 390/391. Featuring a 24-pin print head and 270 cps

throughput, it offers both quality and sophistication at a realistic price.

Ease of use is a key feature of all OKI printers, and the 390/391 devices are equipped with an exceptionally simple control panel. The foil covered touch keys are clearly lit to avoid confusion, and they facilitate simple selection of character pitch and print speed.

OKI's innovation also shows through in the range of options for the 390/391s. If you need to use a typeface other than the standard Courier, for example, tiny typeface cards can be inserted into the printer chassis. The cards provide alternative typefaces such as Prestige Elite and Letter Gothic. Typefaces can be printed in bold, italic, double height and width underscored or width scored through, above and below the line.

Paper handling is also something that the 390/391 does with aplomb. Each printer is supplied with a bi-directional push-tractor as standard, and a pull-action tractor is available as an option. Automatic single sheet feed also comes as standard, and it can be extended to provide fully automatic sheet feed from a single or double magazine. The final flourish is a parking function which simplifies work with continuous stationary and single sheets.

The latest additions to the Microline range are just as exciting. The Microline 320/321 has the highest speed and throughput in its class. Operating at draft speeds of 300 cps, these durable printers have MTBF ratings of 5000 hours.

Like the other Microlines, the 320/321 is exceptionally easy to use. A direct access panel on the front gives you quick and easy control over frequently used selections like type size, print quality and form feed. When you want to stick with one printing format – to fit a particular label or printed form, for example – a lockout feature lets you disable the print options so the 320/321 prints only the type size and style you want.

Despite their advanced features, 320/321 are available for only $799 and $999 respectively.

OKI's arrival in Australia marks an important step in its development. It will undoubtedly make its mark in 1990 when the telecommunications market is thrown open, but there is a much greater significance to its arrival. In the months to come Australia will begin to experience the wealth of innovation that lies behind the OKI name.

Tandy COMPUTERS

Past, Present and Future.

Tandy, the first ten years . . .

Today InterTAN Australia Limited/Tandy Electronics celebrates its 10th year in computers by announcing the release of three new computer models — the Tandy 1000TX, Tandy 1000HX and Tandy 1400LT.

Computers have been a major factor in the growth of Tandy Electronics in Australia. It commenced operations with four stores administered from rented premises in November of 1973 and has grown to become Australia's largest electronics retailer. Today it has over 360 retail outlets and its own $6 million complex housing its Head Office and Distribution facility.

On 3rd August 1977 the world's first fully assembled microcomputer made its debut in New York. It was called the TRS-80 Microcomputer System and was manufactured by Tandy Corporation to be sold through its chain of electronics stores.

Around February-March the following year the TRS-80 reached Australia and began to sell through the Australian Tandy Electronics stores making the first company in Australia to sell Microcomputers.

In the past 10 years Tandy Corporation has continued to expand and enhance its computer line and the three new models released today bring the total number of models manufactured to 34. Tandy Electronics has selectively and successfully marketed 27 of these in Australia.

Tandy has always followed a policy of providing an upgrade path to enable its customers to expand their computers as their own expertise and needs grow.
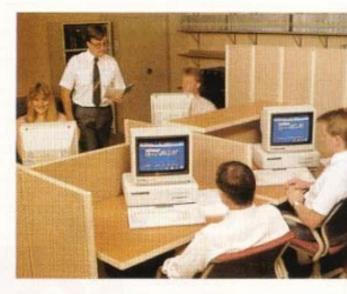
The Model I led to the Model III which was followed by the Model 4 and 4P (Portable). The TRS-80 Colour Computer, introduced in 1980, has evolved into the Colour Computer 3 which is unique amongst home computers in that, with the addition of the optional OS-9 Operating System, has multi-user and multi-tasking capabilities.

The Tandy 6000 which today runs the powerful Xenix Operating System and will support an additional five terminals evolved from the original stand-alone Model II.
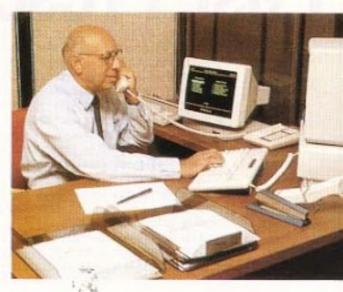
Tandy has been selling and supporting Xenix systems since 1982. With the recent growth in popularity of both Xenix and Unix, Tandy is well placed to service the needs of customers who want the extra power, security and flexibility offered by these systems.

In 1982 Tandy scored another world first by introducing the Tandy Model 100 laptop computer. This model has given way to the Tandy 102 and been joined by the Tandy 200. Today Tandy releases its first MS-DOS laptop computer the Tandy 1400LT.

Up until the time that IBM entered the micro market.

Professional Training. Tandy's training and support is unequalled in the industry. You can select from a variety of hardware and software operator courses taught by Tandy professionals. Your training can be either in-house or on-site.

Customer Support. Tandy provides more support operations at less cost (much of it free of charge, in fact) than any other microcomputer company. Our support specialists are your "on-demand" experts, and can be reached by telephone hotline at 6 nationwide support operations centres.

Nationwide Service. Six strategically located company-owned Tandy Computer Service Centres assure convenient service nationwide — performed by employees of the same company that manufactured and sold you your computer. We back the products we sell.

Commercial Support. Across Australia Tandy offers the business person, teacher and farmer the kind of after sales service and advice that one expects from the leading producer of PC computers. And with our Express hardware and software services, Tandy becomes as convenient as it is economical.

Tandy were neck and neck with Apple for the Number 1 spot and they certainly miscalculated on the impact that IBM was to have.

Sales of Tandy desktop computers took a temporary nosedive before Tandy fought back strongly through the introduction of its Tandy 1000 and 3000 lines of high quality IBM Compatibles.

Tandy does not make clones. Their compatibles are manufactured for maximum reliability, adhere to industry compatibility standards and have added features and higher performance levels without addition to the price.

For example the Tandy 1000 and 3000 line have proven to be exceptionally reliable achieving between 33,000 and 59,000 hours mean time between failures.

The Tandy 3000, which runs the forthcoming OS/2 operating system, is currently servicing MS-DOS and Xenix markets. OS/2 is very much welcomed by Tandy as it will allow enhancements that were previously not possible with MS-DOS.

The success of Tandy in the USA is proven by the fact that in 1986 they sold a grand total of 667,500 computers including 272,000 MS-DOS computers. This was a fraction behind Apple and well ahead of IBM's 457,500. For 1987 Tandy outsold Compaq in selling 403,000 PC's.

The future looks bright for Tandy, who has proven to be one of the most stable personal computer companies both in Australia and overseas providing a wide range of computer products and services.

In a recent announcement Tandy Corporation revealed plans to consolidate the three separate computer plants which assemble the Tandy 1000 line by constructing a new US$7.5 million state of the art computer assembly plant to be operational by July 1988.

The new models released today are very representative of the Tandy style. The Tandy 1000TX offers a new low price for a name brand 80286 machine. The Tandy 1000HX whilst retaining full compatibility adds new meaning to user-friendliness. The Tandy 1400LT now gives laptop users the ability to run the software that they use on their desktop machines anywhere.

In Australia Tandy Electronics has an established customer base in excess of 100,000 and for the November/December period just past sold (actual sales not shipments) an impressive 1847 PC-compatible computers.

Tandy now looks forward to the next ten years in computers with confidence and anticipation with the aim of continuing to provide Australia's Homes, Schools and Offices with an expanding range of well supported, innovative, high quality computer products.

Tandy, the present...

The Australian company trading as Tandy Electronics is a subsidiary of InterTan Inc, the international arm of this very diverse retailer.

Tandy's range of computer and associated products is the most extensive of all retailers, in the electronics marketplace.

Part of Tandy's present range includes the affordable small footprint 80286 Tandy 1000TX, Tandy 1400LT laptop computer and the Tandy 1000HX a home and education system designed around a high user-friendly environment. Tandy also has the Tandy 102, PC-6 and PC-8. The Xenix environment is supported by the Tandy 3000HD a full architectured 80286 multi-user system.

Tandy has a reputation in Australia for providing consumers with the best and most up to date technology that is available. Tandy can do this because of its very large worldwide network of retail stores, manufacturing, and research and development.

Tandy has the largest support and distribution of any other electronics retailer in Australia, with service and support facilities in each mainland state capital city.

Tandy also is one of the few companies that offer dedicated computer analysis of computer equipment, through the companies' Computer Support Centre in Sydney and other relevant states. This keeps Tandy in touch with its large consumer base Australia-wide.

Although the pc market is volatile, Tandy has performed exceedingly well over the last six months and the next six months look even better. There is no other retailer that can match our products for manufacturing, quality control and servicing.

In short, Tandy is well placed in Australia to offer consumers with a high degree of quality, and yet maintain affordable consumer pricing. This was our commitment when Tandy started in Australia and this is our commitment today.

At Tandy...

> We make it.
> We sell it.
> We support it.
> We guarantee it.

Tandy, the future...

Tandy's future is one of the most exciting in the pc field. The introduction of the Tandy 4000 a full architectured 80386 system, together with the LP 1000 Laser printer places Tandy at the forefront of affordable pc's and peripherals.

These new additional machines to our current range will help Tandy's push into the corporate and desktop publishing sectors.

Tandy will also introduce in 1989 the first of its range of Micro Channel systems, ie, Tandy 5000MC. This computer brings a new dimension in personal computing to Australia.

At this time Tandy together with IBM is the only company that has a dedication to micro channel. The MC series in America is literally selling like hotcakes.

This computer together with the Tandy 4000 will establish once again the commitment Tandy has to the Australian computer industry. The Tandy 5000MC will be previewed at a major launch next year.

Tandy also has developed corporate strategies and agreements with Digital Equipment and Panasonic.

These new and very exciting enterprises will consolidate Tandy as the major force in computing well into the next decade.

The Tandy profile over the last couple of years has gone through dramatic changes. No longer do we sit on the fence and let other companies pass us by. We have become very aggressive in our marketing and manufacturing of our computer range. This has lead to Tandy being number one in the US and Canadian markets over the last couple of years.

It is this professional approach Tandy projects that will enforce our commitment to our consumers.

This is why other companies such as Digital Equipment and Panasonic have joined forces with Tandy. Why? Because they see Tandy as a company that has an assured future in high tech manufacturing and marketing. They also know that Tandy is here to stay.

IBM

Was there life before September 1981? Not as far as the IBM PC was concerned, but there was indeed the spark of life in the PC industry at that time. And it was kept alive by a very small and specialised group of end-users who spent most of their time programming, rather than using, their PCs. They were mostly computer literate hobbyists who often built their own systems. Systems which operated within very limited constraints (only 64KB) and which had a music cassette recorder to store their data on and a TV screen to monitor the operation of their system.

As for software; prior to September 1981, it could only be described as "user-unfriendly", since it was written for the computer literate end-user and was generally accompanied by very poor quality documentation. No self-respecting businessman would have anything to do with such things.

When the IBM PC was released onto an unsuspecting marketplace, there were several new and unique innovations that set it apart from, not only the extant breed of personal computer, but from anything else that IBM had ever done before. For one thing, off-the-shelf components were used in its manufacture and it was marketed through a network of dealers, rather than the traditional "blue suiters" who usually handled the IBM equipment.

And at a technical level, the operating system allowed programs to be written to a memory space of 640KB; ten times what had previously been available. In addition to that, the processor chip operated at a much faster speed, both internally and externally, giving one the capability of running much more sophisticated programmes than before. Many people thought that IBM had done an over-kill, and such comments as "Nobody will ever use that much memory", could be heard

around the traps.

But IBM had produced its machine with the concept of "open architecture", i.e. the whole system was laid bare for all to see and the world was invited to build hardware and software that would run on it. The result? By September 1983, just two years later, one could buy a catalogue of programmes that had been written for the IBM PC, and there were over 3,000 entries in that catalogue. And those programmes mostly catered to the businessman and his needs, so a whole new breed of end-user began to emerge.

It did not take long before these new programmes began to push the limits of the IBM PC and its operating system (DOS). And then people started to want more than one programme operating at one time because the hassle of stopping one to start another was getting to be a bore. And then there was the need to connect one's PC to the corporate mainframe computer, so that information could be exchanged more readily. So, by 1984/85 it became obvious to the IBM planners that the operating system and hardware that had seemed so unlimited in 1981, would have to be redesigned.

With faster and more powerful processor chips becoming available (the Intel 80286 and 80386), a new operating system was created; one that could take advantage of the multi-tasking capabilities of the new chips. This new operating system (OS/2) created an environment which was some 20 times larger than the old DOS workspace. It was also possible to leave several programmes running at the same time and to switch instantly from one programme to the next, or to view several of them at the same time through "windows" on the screen.

This new operating system was designed to solve all the software problems

people had been running into, but, by its very nature, it created some new problems at the hardware level. The original IBM PC had not been designed to handle the tremendous demands that such a multi-tasking operating system would generate, so a new basic structure had to be designed. This was called the Micro Channel Architecture and is an integral part of the total system when using OS/2.

So now we have the capability of running multiple programmes simultaneously, including several communications sessions (either with other PCs or with mainframe computers). And the new Micro Channel Architecture also enables up to 16 separate processors to operate at one time on the same system, so this means that sophisticated graphics can be more easily supported, and that several other operating systems can be supported under the one main umbrella (OS/2). But where is it all leading?

One thing is for sure; personal computers, or Personal System/2, as they are now known, will continue to become more powerful, while reducing in size and increasing in price/performance. And that extra power and capacity will enable software developers to accomplish what their early 1980's counterparts were never able to do; produce really user-friendly products.

As more power becomes available, much of that power will be used to cause the complexity of the computer to begin disappearing beneath a user interface that will become so clever, it will make the whole relationship between man and computer a much more civilised and effective experience involving voice, touch and (who knows?) even thought sensitive interaction. More power to the computer — more simplicity to the user.

AT

+

PS/2

MITAC
286V

Do you need AT technology or PS/2 technology? That's the question everybody is asking nowadays, and that's the reason Mitac built the Paragon 286V -- to give you the best of both technologies.

The powerful 12 MHz Paragon 286V gives you the perfect bridge across IBM's "technology-gap." Just for starters, you get integrated 5-1/4" and 3-1/2" disk drives and support for both MS-DOS and OS/2 operating systems. VGA-compatible graphics keep you state-of-the-art and support all your existing software. LIM/EMS memory is expandable up to 8 MB on-board. Space for four storage devices and six expansion slots mean this beautifully designed small-footprint machine is ready to grow with your needs -- all the way up to networking and even multi-user levels.

When you find yourself stuck in a "technology gap" look to Mitac for creative, reliable, fully supported solutions. Call KELLER AUTOMATION for the name of your nearest authorised dealer for support, and genuine manufacturer warranty. -- Telephone Toll Free anywhere in Australia (008) 331-715 NOW.

mitac
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Exclusive Australian
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PARAGON

KELLER AUTOMATION

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Keller Automation are a Division of Edward Keller (Australia) Pty. Ltd., itself a Subsidiary of the Swiss Based Edward Keller Group of comanies with other major interests in Banking, Plastics, Textiles etc.

Keller, established over 100 years ago, are primarily known in Australia as the exclusive TVM and MITAC distributors. Undoubtedly the largest importers and stockists of computer monitors in Australasia, since their exclusive association with MITAC, itself a giant in the computer industry, Keller Automation have become one of Australia's major enhanced compatible computer suppliers, currently supplying well in excess of 2,000 computers per quarter.

The increasing Market demand for "Total Solutions" specifically in the Corporate and Government sectors as well as the success of Keller in the Educational Computer market have made it necessary for Keller's Systems Division to be created.

The most recent addition to Keller Automation's range of product comes from Lightspeed Technologies, and represents the first significant step towards computer to computer true Image Communication System. Software for PC/XT/AT, PS/2 and Apple McIntosh is included. In addition, this Windows driven image/facsimile unit can communicate with all existing facsimile installations throughout the world.

In today's world of uncertain and unreliable suppliers, Keller's main strength is the combination of their sound financial backing coupled with years of stability and Marketing experience as well as the unmatched innovation, quality and reliability of their TVM and MITAC products.

TVM IN BRIEF

TVM, founded in 1973, originally produced the world's first 3-in-one Multi-Display colour monitor, the MD-3. They went on to develop the world's very first Multiple-Sync CGA/EGA monitor, the now famous MD-7. TVM continued to innovate and went on to develop the MD-3V, the first monitor ever to feature a PAL/NTSC composite Video and Audio TV-Link. The momentum of continuous innovation continued with the development of the MD-8 the world's first commercially viable Analogue Monitor, and the MD-24, the first colour monitor with resolution high enough to display all the characters of the complex Chinese alphabet.

Since late 1986 when Keller

Automation were appointed exclusive distributors, over 50,000 TVM monitors have been sold in Australia. Including their OEM business, TVM currently produce in excess of 100,000 monitors per month.

With the introduction of TVM's third generation Multiscan Digital and Analogue monitors, the MD-300, MD-600, MD-700, MD-11, MG-11, MD-12, MD-14, MG-12, MG-14, TVM have doubled their sales. The revenue in 1986/87 for their TVM label monitors alone reached US$86M ranking them last year's largest own-label colour monitor manufacturer and exporter of Taiwan. With the more advanced Multiscan and Analogue models out now, a total TVM turnover of more than US$200M is certain for 1988/89.

QUALITY CONTROL/ASSURANCE CONSIDERATIONS

The exclusive materials selection and stringent manufacturing and testing procedures followed by both TVM and Mitac are second to none.

Such practices have gained TVM and Mitac exclusive O.E.M. manufacturing contracts for many well-known Multinationals.

All their products are manufactured and certified to comply with all relevant International Safety Standards.

Employing the latest automated manufacturing techniques and highest quality control standards, both Mitac and TVM are able to achieve highly-efficient and cost-effective production. These attributes have helped both Mitac and TVM to secure the lucrative but extremely demanding in quality US O.E.M. contracts.

A stringent quality assurance program is in place at both Mitac and TVM and each product goes through at least five stages of QA from the initial prototype through follow-up final testing at the customer site.

- "A" Test: The initial prototype is tested for compatibility with most of the commercially available software packages, and peripheral devices, for compliance with safety and EMI specifications.
- "B" Test: Several dozen machines are taken from a pilot run at the factory and tested for functionality, durability and compliance with other specifications.
- "C" Test: The same tests as the "B" Tests are repeated on samples taken from the first full production run at the factory.
- "ALPHA" Test: Sample units are used in-house at both Mitac and TVM. The R & D department listens to the comments of the in-house users and acts upon the suggestions and recommendations.
- "BETA" Test: Feedback is taken from out-of-house users at the customer sites and R & D engineers revise the products based on these comments.

Combined together Mitac and TVM maintain staff of over 200 engineers exclusively dedicated to research and development. Each product of either Mitac or TVM is a result of input from their marketing, sales, technical and manufacturing divisions. Additionally, Mitac uses advanced CAD Systems extensively in the design of both the circuitry and mechanical elements of their computers, which makes immediate revisions of the products possible and subsequently guarantees that these revisions can be carried out with profound accuracy.

Keller's successful stand during the Melbourne PC88 Show

CUSTOMER SERVICE

Mitac, TVM and Keller Automation feel that providing superior customer service is an important factor in making their products successful in the long run. All three companies have built a very strong customer service organisation by investing millions of dollars in testing and service equipment to support their team of highly-experienced engineers.

Further, their modular system design allows every service centre to carry a wide variety of modules so that when a customer does require service, the Authorised Service Centre or Dealer can quickly isolate and replace any module.

Mitac's most direct competition has traditionally come from companies like IBM, Compaq, Olivetti, NEC and Epson who market through similar dealer networks.

With the introduction of the Paragon family, Mitac seeks to separate itself from the pack by offering products with distinct advantages. The Paragon Series Fourth Generation computers are the first small-footprint computers in the market allowing users to mix and match storage formats to meet their special needs. These PC's have both 5.25" and 3.5" drive slots and direct support for all types of Floppies, Tape Drives and Hard Disk drives in sizes from 21 to 206Mb.

– All Mitac PC's are supplied and fully licensed with the latest issue of BIOS from Phoenix Technologies.

– All Mitac PC's come bundled with the latest issue of Microsoft MS-DOS and GW BASIC.

– All Mitac Personal Computers are tested and compatible with:

- MS-DOS, PC-DOS 3.2 – 3.3 – 4.1
- OS/2
- PC SLAVE
- TURBO DOS
- CONCURRENT DOS
- ETHERNET
- NOVELL NETWARE 86 and 286
- PC/NOS
- PC/MOS
- PC NET
- TRANSNET
- ARCNET
- XENIX V, 286 and 386
- UNIX III, V

– Being Taiwan's exclusive Agents for Microsoft, Mitac are keeping a very close eye on Microsoft's development of the new OS/2 Operating System. Mitac have been assured of availability of the OS/2 system immediately after its initial release.

COMPUTER STANDARD FEATURES and BASIC CONFIGURATIONS

3.5"/5.25" Hard Disks from 21Mb to 206Mb, 3.5" Floppy, and 40Mb or 60Mb Tape Drives are available as optional to all the following Basic Units

PARAGON V88

8088-1(V20) Processor, 10/4.77MHz
5.9 Performance Ratio against IBM XT
512K RAM (Expandable to 768K On-Board)
Hercules, CGA, Plantronics Video On-Board
Serial, Parallel, Clock, On-Board
360K Floppy & Controller On-Board
101-Key Keyboard Standard (84-Key optional)
5 Spare slots, Space for 2 x 3.5"/5.25" Units

PARAGON MPS2

8086-10(V30) Processor, 10/8MHz
1.25 Performance Ratio against IBM PS/2 System 30
640K RAM LIM/EMS Spec On-Board (Expandable to 2.5Mb)
Hercules, CGA, Plantronics Video On-Board
Serial, Parallel, Clock On-Board
3.5" 1.44Mb/720Kb Floppies & Controller On-Board
101-Key Keyboard Standard
5 Spare slots, Space for 2 x 3.5"/5.25" Units

Mitac's PS/2 Series Compatible Computer

PARAGON 286SL

80286-10 Processor, 10/6MHz
11.3 Performance Ratio against IBM XT
640K RAM On-Board (Expandable to 1Mb On-Board)
Hercules, CGA, Plantronics Video On-Board
Serial, Parallel, Clock On-Board
1.2M/360K (R & W) Floppy & Controller On-Board
101-Key Keyboard Standard
5 Spare slots, Space for 3 x 3.5", 1 x 3.5" /5.25" Units

PARAGON 286S

80286-10 Processor, 10/6MHz
11.3 Performance Ratio against IBM XT
640K RAM On-Board (Expandable to 1Mb On-Board)
EGA, Hercules, CGA, Plantronics Video On-Board Serial, Parallel, Clock On-Board
1.2M/360K (R & W) Floppy & Controller On-Board

101-Key Keyboard Standard
5 Spare slots, Space for 2 x 3.5"/5.25" Units

PARAGON 286V

80286-12 Processor, 12/8MHz
13.6 Performance Ratio against IBM XT
1Mb RAM LIM/EMS Spec On-Board (Expandable to 8Mb On-Board)
VGA +, 800x600, PGA, EGA, Herc, MCGA, Plantronics On-Board
2 x Serial, Parallel, Clock On-Board
1.2M/360K (R & W) Floppy & Controller On-Board
3.5" 1.44Mb/720Kb Internal Floppy Option
101-Key Keyboard Standard
6 Spare slots, Space for 3 x 3.5", 1 x 3.5"/5.25" Units

PARAGON 286VE

80286-16 Processor, 16/8MHz
18.1 Performance Ratio against IBM XT
1Mb RAM LIM/EMS Spec On-Board (Expandable to 8Mb On-Board)
VGA +, 800x600, PGA, EGA, Herc, MCGA, Plantronics On-Board
2 x Serial, Parallel, Clock On-Board
1.2M/360K (R & W) Floppy & Controller On-Board
3.5" 1.44Mb/720Kb Internal Floppy Option
101-Key Keyboard Standard
6 Spare slots, Space for 3 x 3.5", 1 x 3.5"/5.25" Units

PARAGON 386C

80386-16 Processor, 16MHz. 80387 Co-processor Option
23.4 Performance Ratio against IBM XT
2Mb RAM On-Board (Expandable to 8Mb On-Board)
2 x Serial, Parallel, Clock On-Board
1.2M/360K (R & W) Floppy & Controller On-Board
3.5" 1.44Mb/720Kb Internal Floppy Option
101-Key Keyboard Standard
5 Spare slots, Space for 3 x 3.5", 1 x 3.5"/5.25" Units

PARAGON 386E

80386-20 Processor, 20MHz. 80387 Co-processor Option
29.5 Performance Ratio against IBM XT
2MB RAM On-Board (Expandable to 8Mb On-Board)
2 x Serial, Parallel, Clock On-Board
1.2M/360K (R & W) Floppy & Controller On-Board
3.5" 1.44Mb/720Kb Internal Floppy Option
101-Key Keyboard Standard
5 Spare slots, Space for 3 x 3.5", 1 x 3.5"/5.25" Units

SERIES 300

Multiuser, same as 386E above and complete with:
100Mb SCSI ULTRA-HIGH Transfer Hard Disk Drive
8 or 16 Serial Port Intelligent I/O Board
SCO Xenix 386 operating system

SELECTING A MONITOR? LOOK CLOSER. DON'T MAKE THE SAME MISTAKE... ONCE.

An objective view of what to look for and what to avoid when selecting your next (or first) computer monitor.

By Nick Sikiotis, Keller Automation.

Let's start with 'the' most important criteria in your selection.

Is it the Resolution?
Is it the Dot Pitch?
Is it the Number of Colours?
Is it the Size of the Tube?
Is it the CGA, Hercules, EGA, PGA, or VGA Card that counts?
Commonly Ignored Points:

MULTI-SCAN VS. DUAL-SCAN

Typically, you will have the need to use a multitude of the above applications, where a multimode (Dual-Scan, Tri-Scan, or Multi-Scan) Monitor and Adapter have to be selected.

There are some excellent Hercules/ CGA, CGA/EGA, and Hercules/CGA/EGA Monitors and Adaptors around.

However, should you decide that a Multi-Scan monitor is what you really need, make sure you purchase a true ALL-IN-ONE Multi-Scan including Video TV-Link Interface and not a 'some-in-one' Multi-Scan. A real Trap.

MONOCHROME VS. COLOUR

If you use your computer primarily for Word processing, Spreadsheets, Accounting or other Business Applications, the 640x350 Dot display is more or less essential.

Should you also need to play some games during your spare time, and you can't afford a Dual-Sync EGA/CGA monitor, consider a Multi-Scan Paper-White Mono Monitor with Multiple Shades of Grey instead of Colours. It is equally exciting.

DOT PITCH IN COLOUR MONITORS

This point may become extremely complicated if you wish to make it.

To keep it simple, just remember: For good Design Graphics ask for .31mm Dot Pitch.

For Games, Video Demos, and Simple Text, .39mm Dot Pitch is good enough.

If you really want to get technical, ask the supplier for details on the Misconvergence and Distortion levels of their Monitors instead.

TUBE SIZE, 12" VS. 14"

For a difference of not more than $50, the 12" Tube is now dead.

The 20% larger 14" Tube makes a great deal of difference, in reducing eye strain and fatigue.

However, with an abundance of 14" Tubes on the market, another major factor emerges for your consideration. The true and effective image area on the screen. In many cases the tube may be 14" but the image is only between 12.5" and 13".

Even though I was expecting fancy Brand names, Watts, and slim line features to be thrown at me, after my initial surprise, the consultant's approach made good sense to me.

Obviously you have to work backwards at these situations, with the 'Application' and the Eight-Twenty rule always fixed in mind.

You select the monitor and adaptor which are designed to support best the Application(s) Software that you will be using 80% of the time.

You don't select the monitor to suit the 20% occupation time of your computer, (possibly the entertainment time) at the expense of its main function and your own eyes.

Here are some hints on several Applications and their video requirements:

Ask to see the Monitor turned on.

USEFULNESS OF MULTIPLE-COLOUR FILTERS

A few leading Brands of colour monitors offer a multiple-colour filter switch mounted on the front panel.

Even though at first this feature appears to be somewhat gimmicky, in essence it turns out to be extremely valuable for slightly colourblind people, or people whose eyes are irritated by one or several colours.

Another use of this feature is for total or partial masking of one or more colour layers during colour operation, for more effective and creative presentations.

A must for your monitor.

ON SCREEN COLOURS, 16 VS. 256

Since most Design and Graphics Software packages support only 16 out of 64 colours, the 256 out of 256K colour Adaptors may be an overkill.

Unless of course you are dealing with Analogue (Video Enhanced) Applications where a minimum of 256 Colours are needed. Here a true Analogue monitor is required in order to give you an infinite number of colours.

SOFTWARE DRIVERS

After purchasing a higher resolution graphics monitor, you may be extremely disappointed to find out that the improvement from the previous monitor is not as substantial as expected.

It is more likely that your software is either not 're-installed' properly, or not able to support that higher resolution.

Ask for them by name.

ERGONOMICS

The Tilt and Swivel Stands are a necessity to a modern monitor either as a standard accessory or as an option.

A non-glare tube surface is perhaps the most important feature to look for.

Don't buy your Monitor without them.

WARRANTY

The only item of your computer system which if it ever decided to die it certainly takes its time, is the monitor.

A 12-Month extended and unconditional Warranty is a must.

The most recent addition to Keller Automation's range of product comes from Lightspeed Technologies, and represents the first significant step towards computer to computer true Image Communication System. Software for PC/XT/AT, PS/2 and Apple McIntosh is included. In addition, this Windows driven image/facsimile unit can communicate with all existing facsimile installations throughout the world.

APPLICATION	MINIMUM TYPE/COLOURS	RES.	RECOMMENDED TYPE/COLOURS		RES.
Word Processing Database/Accntg.	Herc/Amber	720x350	EGA	64	640x350 Dots
Spreadsheet	Herc/Amber	720x350	EGA +	64	640x480 Dots 132x25-44 Col.
Games	CGA/16	320x200 640x200	VGA +	256K	800x600 Dots
Desktop Pub.	Herc/White	720x350	PEGA +	64	800x600 Dots
CAD/CAM	EGA/64	640x350	VGA + +	64	1024x768 Dots
Paint Brush	EGA/64	640x350	PEGA +	64	800x600 Dots
Image Capture	PEGA/64	640x480	VGA +	256K	800x600 Dots
Video Training & Presentations	PAL/Analogue	640x400	VGA +	256K	800x600 Dots

Put the worldwide network of 3 million facsimile machines in your computer window

LIGHTFAX APPLICATION SOFTWARE INCLUDES

MICROSOFT WINDOWS INTERFACE
— Easy to use, easy to operate
— Multitasking
— Can be a node or workstation of local-area network

NAMECARD DATA MANAGEMENT
— Create Namecards of customers, vendors and friends
— Send facsimile directly from Namecard
— Easy to search, add, delete and modify

PAGE EDITOR
— Edit full page documents
— Merge title, text, graphics
— Create multipage documents
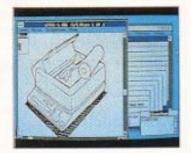
CONVERSION
— Conversion among Pagemaker (.TIFF), Windows Paint (.MSP), PC Paintbrush (.PCX), LIGHTFAX and other popular software formats

BROADCASTING/FILE QUEUE
— Transmit documents to multiple addresses
— Save time, expense
— Transmit multiple files

SENDING
— Send directly from a disk file
— Automatically convert ASCII files into facsimiles
— Scheduled sending to take advantage of late-night call savings
— Background transmission

RECEIVING
— Stores incoming fascsimiles directly on disk or prints out to a printer
— Files can be archived in a file server
— Background receive

VIEWING
— View incoming/outgoing facsimiles and page files
— View JOURNAL reports of sending, receiving, broadcasting and faxlist activities

LIGHTFAX 9620

TD RD TR CD OH AA 96/72 48/24 12/03 FAX/MODEM BELL/CCITT

ASSCO
ON THE MOVE

ASSCO have lived up to their promise and their name.

By offering specialist services as an AutoCAD Sales and Support COmpany, ASSCO have gone from strength to strength since their formation in 1981 and are now one of Australia's largest and leading AutoCAD dealers.

When it comes to increasing productivity through CAD/CAM systems, ASSCO have the products and services professionals need in order to prosper in today's business world.

The success of ASSCO, and their clients, prove it.

A HUNDRED YEARS UPDATE IN A MINUTE

The old Victorian Railways Offices, Melbourne, are about to get a new lease of life.
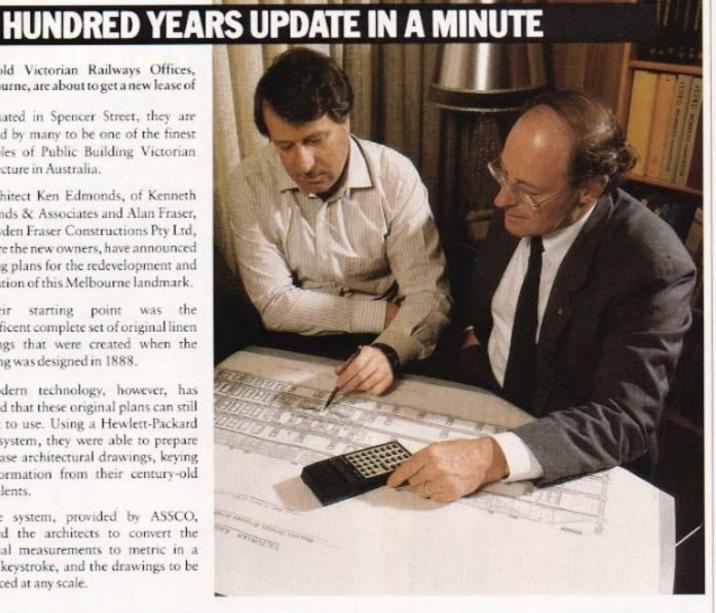
Situated in Spencer Street, they are claimed by many to be one of the finest examples of Public Building Victorian architecture in Australia.

Architect Ken Edmonds, of Kenneth Edmonds & Associates and Alan Fraser, of Bowden Fraser Constructions Pty Ltd, who are the new owners, have announced exciting plans for the redevelopment and restoration of this Melbourne landmark.

Their starting point was the magnificent complete set of original linen drawings that were created when the building was designed in 1888.

Modern technology, however, has ensured that these original plans can still be put to use. Using a Hewlett-Packard CAD system, they were able to prepare new base architectural drawings, keying in information from their century-old equivalents.

The system, provided by ASSCO, enabled the architects to convert the imperial measurements to metric in a single keystroke, and the drawings to be produced at any scale.

KIRBY'S QUEST

In 1986, Cedric Israelsohn, Technical Services Manager at leading tool and die manufacturer, Kirby Engineering, saw an early format of a CAD/CAM package at the Swinburne Centre for Engineering Technology. The package, called CAMPAC was under development at the Centre and it was only by chance that Cedric came across it.

He was delighted to find a system that appeared to offer just what he was looking for to simplify the generation of CNC cutter paths at Kirby's.

Practical

The design team at Swinburne had used the simple-to-operate yet versatile software of AutoCAD for entering the information on the component to be machined. CAMPAC then generated the cutter path instructions directly into CNC machine code.

It was a down-to-earth but very practical approach to the task; easy to learn and ideally suited to the CAM environment.

All-round dividends

In the intervening years much has happened. The system was refined and completed, including trials at Kirby's factory. ASSCO took over the marketing and distributorship of the package.

CAMPAC has been widely accepted by the metal working industry with users reporting overall productivity gains in the order of 300% and many other benefits such as no machine downtime during program preparation.

Cedric Israelsohn's chance meeting at Swinburne has paid dividends all round.

EXPO one day, ASSCO the next

Life is returning to normal in Queensland after the excitement of EXPO '88. And whilst the opening of the new ASSCO office in Brisbane might not seem to have the same degree of national importance to some, business professionals have every reason to celebrate.

As part of the expanded ASSCO network, and with their experience in the computer and metal working industries, State Manager Tony Land and his staff are well-equipped to advise clients on the best means of increasing productivity through CAD/CAM systems.

Surveying the past, present and future

ASSCO regard the final run up to the end of their first decade of service with considerable enthusiasm. And with good reason.

Since the company's formation in 1981, the compounded annual growth rate has exceeded 50% and ASSCO have every reason to expect the trend will continue or even accelerate.

Pioneers

When first formed, ASSCO pioneered the use of Hewlett-Packard advanced calculators and early CP/M micro computers to assist surveyors in the field and with computations.

The record of advanced service to surveyors remains unbroken up to the present, both in terms of assisting with the choice of hardware and software, and helping with all other aspects of their practices.

Nowadays, ASSCO service a much broader range of professionals by supplying and supporting CAD/CAM systems for Architects and Civil, Mechanical and Electrical Engineers as well as their Business Management and Presentation systems.

Stability and growth

At present ASSCO have a staff of 24 in the Melbourne office and there are 4 at the newly opened Brisbane office. Monthly turnover is now running at a rate of $10 M p.a.

According to Marketing Director, Denis Hitchens, the company's growth and leading position in the market place can be attributed to good planning and an uncompromising desire to offer customers increased productivity and hence profits.

The hi-technology industry is extremely competitive and dynamic, so it is comforting to find a company like ASSCO that has a history of stability and steady growth achieved through financial strength and sound strategic planning.

List of AutoCAD third-party enhancements grows

As the country's leading AutoCAD Sales and Support Company, ASSCO have made a significant contribution to the acceptance of AutoCAD as the de facto standard for micro computer-aided design systems, as used by design professionals, contractors, architects, engineering consultants, federal and local government agencies and suppliers to these professions.

In addition to the productivity benefits experienced by individual users, it has also meant that they are easily able to exchange drawings amongst each other.

Enhancement

ASSCO distribute third-party enhancement programs to AutoCAD. The list grows and now includes:

CAMPAC – Intepreter of AutoCAD drawings directly into CNC control languages.

SYNTHESIS – Engineering spreadsheet which allows parametric design and drawing.

DRCAUTO – Allows Architects and Building Designers quick and easy access to the full power and scope of AutoCAD.

SHOP DETAILER – Enables fully dimensional and annotated shop fabrication drawings to be automatically produced to AISC standards.

ASSCO review third-party enhancement programs on a continual basis and select the best for recommendation to their clients.

STOP PRESS

ASSCO wins H-P award
At the International Dealer Meeting recently held in Hawaii, ASSCO were awarded the 1988 Hewlett-Packard Victorian Dealer of the Year.

The day Arwon won the Melbourne Cup

ASSCO are leading suppliers of pens, paper, film and other consumables such as ribbons and toner for computer installations.

The company prides itself on the standard of its service to existing and new clients both in Victoria and interstate.

Offering a superior service usually has its own rewards but sometimes there are penalties too.

Office Manager Jackie Wilde recalls with a wry smile an event in the early days of the company.

It was Cup Day in Melbourne and everywhere was shut – much to the despair of a local architect who simply had to have new pens and cartridges for his plotter or miss out on a multi-million dollar bid.

He tried everywhere to no effect until he rang ASSCO and left a message on the answering machine. One of the Directors was catching up on paperwork and happened to play back the tape. He rang Jackie.

Jackie came in to open the office and made sure the architect got what he wanted.

She never did get to make her yearly bet on the big race. And, of course, her selection was Arwon.

At least ASSCO still has the client.

From Marsh to Marina

The Patterson Lakes Project has proved that unwanted marshland can be transformed into a highly desirable living area.

Over 34 hectares have been converted into tidal waterways, and to what has become Melbourne's only tidal waterway living area with full underground services and a marina.

Computerised systems played a major role in developing the complex plans need for the transformation.

Peter Shellie, Estates Development Engineer, Fisher Stewart Pty Ltd, claims that the quality and reliability of the computers used in the project increased their productivity to levels that seemed unachievable only 2 to 3 years ago.

"The systems, provided by ASSCO, increased our throughput by over 40%," said Shellie. "We can now input engineering survey information directly on to computer, create digital terrain models, carry out all aspects of design, then output to plotters for final plans.

"The fact that we completed plans, ready for construction, straight out of our computer system, certainly helped us turn the tide on the Patterson Lakes project," he said.

EASTERN MICRO ELECTRONICS

- A Profound Story

Eastern Micro Electronics Aust. Pty. Ltd. is one of Australia's top 50 computer companies and currently turns over $32.5 million annually.

Wholly Australian owned, EME is an importer and distributor of high quality personal and business computers, software and peripherals. Product ranges currently distributed by EME include Profound computers, OMT monitors, Brother printers, Microsoft software and Psion Organiser II hand-held computers.

The Company

EME was founded in 1980 by Joe and Ann Lazar and still remains a family concern with both parties still actively involved as directors of the company. With a nationwide dealer base and offices in four states. EME has experienced a constant and controlled growth since it's inception.

EME operates under the premise that the public and corporate spheres require quality products at competitive prices with the confidence that they will be supported. As a distributor EMEknows that the secret of success is to provide it's dealers with everything the public requires - service, support and technical back-up combined with quality ranges of products. These they believe are the foundation stones of a successful distribution network.

Joe Lazar's previous experience in the export industry prior to founding EME, has given him a solid grounding in business and trade practices and an ability to perceive market trends as they occur. His business acumen is largely responsible for EME's success in constantly retaining a wider vision of the industry, especially important in the highly charged computer field. It has been Lazar's foresight that has allowed EME to move ahead in this rapidly developing. competitive market.

EME
EASTERN MICRO ELECTRONICS

The People

Eastern Micro Electronics began importing the Profound range of computers from Taiwan in 1983 while operating as a dealer in Bank Street, South Melbourne. By late 1984, with Profound's market share secure, EME decided to source parts overseas and assemble the Profound range on their own premises thereby ensuring greatly enhanced quality control and dealer support. This proved to be a major turning point in the company's development.

By early 1985 with local assembly of the Profound underway, EME moved from the retail to the distribution market further expanded by opening an office in Sydney and began building the extensive dealer network that is now one of it's greatest assets.

In order to meet the increasing local demand and to consolidate it's dealer base, EME were compelled to source it's own range of monitors. This resulted in the introduction of the OMT range of mono, colour, EGA, Multiscan and VGA monitors to the Australian marketplace.

In September 1985, a new building was purchased in fashionable Park Street, South Melbourne to house showroom, administration, assembly and warehouse facilities. This was a move which proved to be shortlived, for within twelve months it was apparent these new premises were not large enough for the rapidly expanding EME.

.Melbourne architect Luciano Palma was engaged to convert an old BHP archives warehouse in Tope Street, South Melbourne. By September 1987, the $3 million complex was complete. Encompassing 16,500 square feet, the building includes office and administration space, two reception areas, tele-marketing and training rooms, and conference facilities. Also housed are sophisticated warehousing facilities that include a two level conveyor-belt driven storage area and an extensive technical service and assembly area to ensure timely delivery.

With offices in Melbourne, Sydney, Adelaide and Brisbane, Eastern Micro Electronics now have a staff over 50 personnel with a key management team that boasts over 80 years experience in the computer industry.

Ann Lazar, Company Director and Financial Controller has overseen EME's financial dealings since the company's inception.

General Manager, Trevor Bole-Brown has over 30 years experience in the computer industry, having begun with IBM in 1956 and later working with NCR both here and in the United Kingdom.

National Sales Manager, Bretten Zagrzejewski has spent the past 13 years with Honeywell, Case Communications and NetComm as Victorian Sales Manager.

Technical Manager, Len Grasso has extensive experience in the video, audio and television fields, and was Work Station Support Manager for the Erickson PC group and Technical Manager for the Myer Computer Centre.

Warehouse Manager, Robbie Lazar has controlled EME's distribution and manufacturing network.

The Products

The Profound range of personal and business computers has been the mainstay of EME's steady growth in the marketplace. With quality parts sourced overseas , and fully assembled here in Australia, the Profound range comprising Compact 8088, Compact 80286 and Tower 80386 have proved to be one of Australia's top-selling computers.

Psion PLC of the United Kingdom approached EME in 1987 with the view to distributing the OrganiserII product range of hand-held computers and periphals. With a multiplicity of user options as varied as barcode reader, stock control , spread sheet, diary and alarm, and with up to 320K of memory and CommsLink capability, the OrganiserII is currently employed as the standard marketing and stock control unit of the Faulding pharmaceuticals group.

Microsoft Software has also been been impressed with EME's performance, to the point that EME is now Australia's leading Microsoft distributor. Microsoft in recognizing this achievement recently named EME as exclusive Southern Region distributor of MS Dos and Victorian sub-distributor of the Microsoft range. Joe Lazar recently met with Microsoft co-founder Bill Gates to sign a $1.36 million bundling agreement.

EME have also been appointed Victorian State distributors for the Brother range of printers which consolidates the relationship established between the two companies over the past four years.

During the recent worldwide RAM chip shortage, EME looked ahead for manufacturers of the decreasing commodity. Micron Technology Inc. of the United States manufacture not only RAM chips but memory cards and looking favourably on EME's position in the Australian marketplace, appointed EME as the Australian distributor of Micron DOS and Apple formatted Extended/Expanded Memory Boards ranging from 2MB to 16MB.

With clients such as National Mutual, CSIRO, Elders IXL, Royal Bank, Hoechst, OCE, Gillette, Fauldings, Pyramid Building Society, Anitek, ASEA, Telecom and Scitek, EME holds a healthy position in the computer marketplace.

But EME does not forget thet it's strength is based on it's extensive dealer network. EME believe in supplying it's dealers with a one-stop shop and distribute a varied range of products that enable it's dealers to concentrate their purchasing. With strong technical support as well as general support such as that for tender applications EME maintains a healthy relationship with it's dealers.

EME is currently in the process of expanding it's operations to include a manufacturing plant overseas with the potential of releasing the Profound range of computers on the international market. With strong growth here in Australia, and growth expected internationally, Eastern Micro Electronics Aust. Pty. Ltd. is a wholly Australian owned company looking forward to it's future.

Automating your accounts

In this final chapter of our three-part series, 'big-eight' accounting and management consulting firm Touche Ross concludes a review of multi-user packages which run on local area networks.
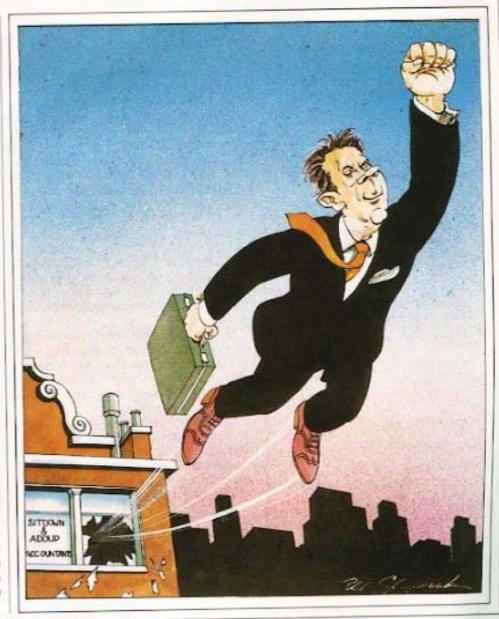
This article completes the series of reviews by Touche Ross covering 28 accounting packages available on the Australian market. The accounting systems have ranged from single-user MS-DOS through NetBIOS LANs to Xenix/Unix multi-user compatible packages.

In this issue, Touche Ross has reviewed several of the 'golden oldies' and some of the newer promising packages. Touche Ross has deliberately not ranked the packages or selected one package as being the best, as so many of the accounting systems reviewed do most things at least to an 'average' standard and have further developed one or two features of the package. Other packages are targetted at specific markets, and a general ranking would be unfair to vendors.

There is a danger of contracting toxic option syndrome by trying to select the appropriate package for your business by reading every brochure and pamphlet in sight, and doing the demonstration circuit. Often a call to the right consulting firm can help your business short circuit the selection process, and increase the chance of success by taking care of the implementation while you run your business.

Academy

Academy is an ideal package for the organisation looking to upgrade to multi-user software. It is designed for the multi-user market, and though it will run on single-user machines, it performs best on DOS networks or using the features of the Xenix and Unix operating systems.

```
┌─ BUSINESS MANAGER ─────┐
│ 1 Debtors              │
│ 2 Creditors            │    ┌─ GENERAL LEDGER ──────┐
│ 3 General Ledger       │    │ 1 Initialisation      │
│ 4 Office Costing       │    │ 2 File Maintenance    │    ┌─ FILE MAINTENANCE ────────┐
│ 5 Payroll              │    │ 3 Screen Enquiries    │    │ 1 Account Categories      │
│ 6 Cash Manager         │    │ 4 Transactions        │    │ 2 Ledger Parameters       │
│ 7 Day to Day Options   │    │ 5 Printed Reports     │    │ 3 Accounts & SubAccounts  │
│ 8 Electronic Mail      │    │ 6 Year-to-Date Report │    │ 4 Monthly Budget Figures  │
│ 9 Operating System     │    │ 7 Periodic Processing │    │ 5 Last Year's Figures     │
│                        │    │ 8 GL Integration      │    │ 6 Add a Trading Account   │
│                        │    │ 9 Change Current Ledg │    │ 7 P/L Report Formats      │
│                        │    │                       │    │ 8 Notes to Accounts       │
│                        │                                 │ 9 Validate GL Categories  │
│                        │                                 │ A Change Current Ledger   │
```

DESIGN COLLABORATIVE P/L
[Licence: 410011]

Use Cursor Keys or Numbers to Select. F2 for Help. Q to Quit.

Academy's main menu gives details of all files within each module

Implementing multi-user sites is a complex procedure, (remember it was not too long ago that a whole EDP department was required to keep things going), so Academy's helpful documentation is a bonus. The Academy package has some useful checklists that explain the procedures for making the implementation as smooth as possible.

As well as the checklists, Academy has the aptly named 'Teacher Pack' that provides an online tutorial and a facility to run test data. The standard manuals for each module are also well set out and indexed.

Academy runs on the fourth-generation language Progress and requires a large amount of disk space to operate. Our sample DOS system running Progress and all modules required over 20Mbytes!

All reports in each module have the option of being printed or displayed — a great time and paper saver. Academy also has electronic mail, which can be an effective means of enhancing communications between users.

The online help has the unique feature of a private menu which can only be accessed by the user with the module password. It allows the user to enter programs directly, rather than going through the main menu.

Review of modules

General Ledger Academy is designed to meet the needs of a wide variety of business environments, and subsequently its General Ledger will handle a number of different trading structures including sole traders, partnerships, trusts and companies. Integrated with the Time Costing Module, this ledger is even suitable for client accounting in professional offices.

A default Chart of Accounts can be used or an individual chart can be created to suit the user's needs. The chart can also be copied to branches.
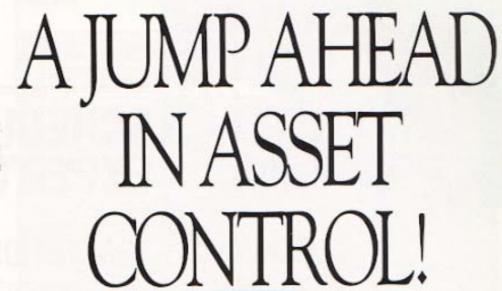
A special feature of Academy is dual-screen batch data entry. One screen provides for extensive checking and includes optional verification of account codes, while the other is designed for use by professional operators whose prime requirement is to enter data at maximum speed.

Transactions are entered using balanced batches which may be edited until posted. A batch that has been posted may be 'unposted', in which case all of its entries will be reversed out of the ledger and the batch becomes available for editing. The transaction log will record the original posting and subsequent reversal.

Accounts Payable The Creditors Module can be integrated or standalone. The main feature is the ability to set default values to streamline data entry.

All creditor accounts are classed as open item, with paid invoices being deleted at the end of the month. A Daily Log File is maintained providing the necessary history and audit trail.

Purchase details are kept for 13 accounting periods for the current year and the previous year for both creditors and user-defined purchase categories, which

enables the production of Trend Analysis reports.

A nice feature for users with colour monitors is a highlighter that uses various colours for different creditor items such as outstanding balances, credit limit exceeded and last payment dates.

Temporary creditors can be entered so that they are purged from the system when their transactions are complete. The accumulated transaction history for each deleted record is transferred to a sundry creditor record which is used to collect sales statistics.

Accounts Receivable The Debtors Module can track transactions on a balance forward or open item method. Sales details are kept for 13 accounting periods for the previous and current year enabling the production of extensive sales statistics reports.

As with the Creditors Module, default settings can be entered to streamline data input. The system will accept any alphabetic or numeric characters, up to a maximum of 10 characters.

As well as defining sales categories, there is the facility to classify debtor groups. The highlighting facility is also available for debtors records.


```
THE UNIVERSAL CORPORATION                                    Nov 23 88
 ┌─ACCPAC Accounts Receivable Master Menu─┐
 │  ┌─Automatic Charges Menu─┐            │
 │  │ 1. Charge interest                   │
 │  │ 2. Print interest posting journal    │
 │  │ 3. Process recurring charges          │
 │  │ 4. Print recurring charges journal   │
 │  │                                       │
 │  │ 8. Housekeeping                        │
 │  │                                       │
 │  │ Q. Quit                               │
 │  └───────────────────────────────────────┘
```
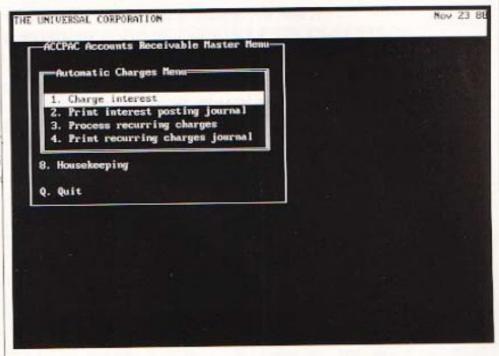
Accpac's automatic application of interest and recurring charges to customer accounts is not readily available in many other packages

Invoicing Invoices, credit notes and consignment notes can have multiple addresses posted and printed in a batch or individually.

A Daily Log File is maintained providing the necessary history and audit trail. The screen enquiry is well designed and allows the user to view reports such as invoices in numerical order, unposted invoices, backorders, salesperson performance and profit margins.

Facilities exist to handle quantity discounts, debtors discounts, sales tax status and payment.

Inventory Stock levels are automatically updated by stock movements generated within the Invoicing and Purchasing Modules.

An inventory code of 13 alpha/numeric characters is required, with all stock items being allocated sales categories. The facility also exists to sort stock by description, and Academy can handle inventory which is 'bought in' for immediate resale.

Office Costing This module provides information about office productivity, highlighting the level of overhead recovery, and ultimately, the cost of maintaining these overheads.

Cost transactions such as hours, overheads and disbursements are entered for all clients via timesheets. Fee-earner productivity is highlighted against standards and/or budgets.

Payroll This module handles both casual and regular employees. It monitors leave, calculates tax on gross incomes and produces group certificates at the taxation year end.

Two report menus are available detailing employee information and statistical summaries.

Cash Manager The Cash Manager is basically an automated cash book with multiple bank accounts. In its standalone mode it can be used to record receipts and payments in place of the Creditors and Debtors Module. When integrated, the module is primarily used for cash flow forecasting and bank reconciliation.

Conclusion

Academy is an excellent package for those expanding into a multi-user environment. It is well documented, attractively priced and has good support facilities. It will run on any machine from a Pyramid to an IBM-compatible '286.

With features such as field defaults, screen highlighting, easy account track-down and on-screen report display, life for operators can be reasonably comfortable.

Accpac Plus

Accpac Plus has been developed within the Canadian market, and while suitable for Australian requirements, still utilises foreign terms such as 'Form 1099', which can be more than irritating at times.

Accounting modules are supplied with a System Manager, accessed through a pull-down menu. System Manager provides a series of utilities, in addition to a DOS facility, allowing operating system tasks to be carried out while maintaining Accpac in the background.

Other Manager utilities include security maintenance, report redirection to file, screen or printer port and selection of printer type (the list is exhaustive). The Manager even allows the error beep tone to be adjusted to your comfort level.

Optional modules include a Window Manager and the LAN pack. Window Manager, while not mandatory, gives a user the ability to perform multiple tasks

by switching windows. You may wish, for example, to direct reports to one window while keeping open sales order entry in another.

Error messages are specific to the error they identify, leaving you in no doubt as to your mistakes. Online help appears as a pull down window and rates highly in comparison to competitor products. Help is context sensitive and provides easy access to further detail or related topics. It provides help for both the procedural implications of your actions and the field contents.

Other features of Accpac include password protection, multi-company

processing, data integrity routines and a scrolling mechanism for reports directed to the screen.

There are 14 different modules in all, including General Ledger, Time Billing, Receivables, Payables, Inventory, Job Costing and Order Entry. Additionally, over 100 add-on or vertical market applications are available from third-party suppliers.

Review of modules

General Ledger General Ledger is a well-featured module providing a high degree of flexibility. Twelve or 13 accounting periods are allowed, with transaction processing and reporting available in future periods — in fact reports can be generated as at any accounting period within the financial year.

A detailed report writer, able to specify both the horizontal and vertical formats of the report, is available for the experienced user. Consolidation of accounts, accumulation of subtotals and calculated fields are all featured. Be warned, however — if you are a novice user, then the 'Quick' report writer is probably the option you should use.

Other features include standard journals and reversals; import/export of ac-

count balances and budgets to spreadsheet and other programs, editing of historical comparatives and budgets, special journals affecting prior years accounts and retained earnings, integration to other modules in the accounting suite, online account enquiry of budget, last year, and current year MTD and YTD.

A department structure is optionally available, while multiple companies can be accounted for by creating new data files for each company. Consolidation of companies is possible but slightly convoluted, as you must import the subsidiary companies into a consolidation company as departments — a minor irritation if you can utilise the macro function in the Window Manager.

Accounts Receivable The software provides flexibility in set up and covers most of the usual requirements. User specified aging of transactions in customer enquiry/reports is impressive, along with enquiry access of past years' transactions.

Some useful features not readily available in competitor products include automatic application of interest and recurring charges to customer accounts, and import and export of transactions to external applications such as Lotus or SuperCalc, dBASE and other data formats.

At a glance

Accpac Plus
Supplier: MicroAustralia
Tel: (02) 736 3299
Price: GL, AR, AP and Inventory, $850 per module. Other pricing is module dependent.
Requires: DOS 3.1, OS/2, 512k RAM.
In short: Flexible software with high-standard modules. Provides good interfaces with other software.

FEATURE

If Window Manager is installed, simply pressing a function key will record the sequence of functions that you perform during month-end statement processing, for example.

This sequence or macro can be recalled and repeated next month with a single keystroke, similar in concept to macros within most popular spreadsheet software.

Integration to Sales Order Entry, Time Billing and Job Costing systems is optionally available. Transfer of data to the General Ledger can be via multiple debtor control accounts, bank accounts and sales dissections.

Accounts Payable Like the other modules, instruction manuals provide sample forms for converting your manual systems. It is an example of the attention to detail that has gone into the documentation provided with the package. Period end procedure flowcharts, transaction flow diagrams and report format planners are yet other examples of good documentation.

One of the unique features available to experienced users is the ability to design and customise the exact look and content of cheques and advice stubs. The same facility allows invoice, statement and remittance advice design in Receivables. In addition to determining the content and position of information on a form, you can nominate whether the advice will print above, below or separate to the cheque.

Key features of this module include prioritising payments, holding and forcing payments on specific invoices, editing the due date of invoices for automatic payments, accumulation of discounts missed by late payments, cheque reconciliation on multiple bank accounts and an aged cash commitments enquiry/report with user-specified aging.

The Accounts Payable Module is relatively strong, and integrates to job costing and multiple general ledger accounts. Disappointingly, the Payables Module does not allow the inventory file to be updated with purchases at time of supplier invoice entry, although there is a third-party supplier add-on that allows this.

Conclusion

This suite of software is flexible, especially in forms and reports generation. It appears to provide good interfaces with spreadsheet and other software. The range of modules not discussed all have the same high standard of manuals and help facilities. With prices around $850 per module, it represents a competitive product.

Charter Series

The Charter Series is a well presented accounting package with effectively-structured screen layouts. While the manuals are informative and well written, the print size is not practical, especially when you need to glance from the screen to the tiny print.

All modules are limited to 32,000 accounts. Unlike most accounting packages, Charter does not use batches to collate data for input. Even though all PC-based packages are online, the batching of data is an important control. In operations that process a lot of data this can be a serious problem.

Another drawback we noted is that there is no obvious way of scanning through records if an account code is not known. This is irritating when trying to search for a creditor's code or a little-used inventory item. The search facility is a common feature of many PC-based accounting packages.

Dealer support for the Charter Series is of a high standard, with the distributor providing dealer training as well as hotline support for the more complex problems.

Review of modules

General Ledger The chart of accounts allows freeform design to suit the user's individual requirements. One major ledger system can establish ledgers for up to 31 companies, each comprising 99 divisions, departments or cost centres. Each division can have up to 9999 main accounts and each main account 99 sub-accounts.

The report writing facility within the General Ledger allows the user to produce reports in which you can determine the layout and details for any portion of your current financial year, with comparisons to budget, last year or preceding monthly figures.

The General Ledger can distribute amounts on a percentage basis between sub-accounts.

Although the manual referred us to the end for sample reports, our copy contained no such reports.

Creditors Ledger This allows the user to enter supplier invoices, analyse purchases with a series of reports and pay approved invoices. It is restricted, however, by its ability to select invoices for payment only by supplier number.

The best feature of this module is the 'Analysis Files', which allows the user to establish an analysis of creditor transactions in a matrix, yielding monthly and yearly values and percentages in terms of parameters set by the user.

The Creditors Ledger is restricted to

Charter's Debtor Cash receipts allocation screen where open item receipts can be allocated against the invoice

the 'open item' system of recording transactions.

Debtors Sales Analysis This module provides three types of sales analysis files — Customer Analysis, Transaction Analysis and Line Analysis — which allow the user to set the parameters. Another feature of the module is the option to define three different levels of dunning letter to be used to remind overdue creditors. The letters are produced according to hierarchy. Statement presentation depends on settings made in the Maintain System Option section.

The Debtors Module establishes your debtors on a balance forward or open item format, or a combination of both. An option exists to automatically amalgamate selected branch accounts onto one head office statement. Sales analysis and banking details are held on record, for use in report generation. At

the end of each session of transaction entry, a transaction audit trail report is automatically printed.

Order Processing For companies running multiple branch stocks, this system will interact with the appropriate branch records and update the relevant sales analysis records.

A ledger update option is used to transfer details from printed invoices and credit notes to the inventory and debtors ledgers. Documents can be altered, maintained or reprinted within the order processing system, until the ledger update option is run.

The reports and enquiry facilities provide current information to assist full order and back order management. They are designed to prompt customer contact before a crisis develops. The content and layout of all the relevant documents is mainly user-defined and is not difficult to implement.

Inventory Control Purchasing IAL has adopted a policy of including a stock monitoring system that will provide sufficient information for the method of inventory measurement used. There is a large number of report types that can be printed to analyse sales, movement, purchases, re-order levels, usage and stock quantities. This module does not pretend to provide complex evaluations of stock movements, but instead gives ample information to be manipulated by the user.
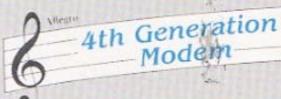
Conclusion

The Charter Series is a great survivor in

```
[0 GPAC]              GENERAL LEDGER ACCOUNT MAINTENANCE          23 NOV 1988




               1 - Define Chart Of Accounts Components

               2 - Define Standard Accounts Components

               3 - Chart Of Account Maintenance

               4 - Standard Account Maintenance

               5 - Copy Standard Accounts Into G L




               Selection Please -

<GLMAINT1>       ?-Help, ?m-Help for Option n            PRINTQ 0
```

GPAC allows users to define their own Chart of Accounts format. It is quickly constructed by replicating standard charts

a marketplace where five years is a long time. The product had been continually adapted in response to requests from users with increasingly greater expectations from accounting software. Charter runs comfortably in both a multi-user environment on major PC network systems and in the original single-user mode.

Charter does, however, lack the flexibility of the newer 4GL packages and in comparison, shows its age.

GPAC

GPAC runs on the Pick operating system which was developed by Dick Pick in the early 1970s. Pick is a multi-user operating system which has a mini/mainframe flavour that most micro users will not be used to. It is unusual in that it comes complete with a variable field length database manager, a high-level programming language (Pick/Basic), an easy to use database enquiry language (Access) and a word processor. This is in addition to more common operating system features such as a text editor, print spooler and virtual memory manager.

In addition to Pick/Basic and Access, Pick Products used Wizard to develop GPAC. Wizard has won the Pick Industry award for the best 4GL for the last three years.

Because it is based on the Pick operating system and Wizard 4GL, GPAC has some unusual features and qualities. For example, the standard reports can be modified, and the user can generate his

own reports using the Access query language or write new reports using Pick/Basic, Wizard or a combination of both. Surprisingly, Pick Products supply the GPAC source code and will support the changes made by users. Thus, GPAC appears to be a package which is suited to specific industry groups requiring special modifications.

The online documentation can be changed by the user to accord with changes made to the modules. The GPAC manual is automatically generated from the online documentation.

Applications which read and/or write data in journal form can be integrated with GPAC. Also, Pick Products offers the Pick spreadsheet with custom hooks into GPAC, which allows users to perform advanced financial modelling on data and to write the results back to the package.

GPAC has extensive security features. Access can be given to each user on the basis of menu level, accounting function or on a program-by-program basis. Thus, the accounts receivable staff might only have access to the receivables programs, while the general manager might have access to all enquiry functions, but not the update screens.

Review of modules

General Ledger The user can have virtually any format of Chart of Accounts. It can be a single company or a number of

companies. Each company can have its own unique structure of accounts. There can also be any number of cost centres. Each of the components of an account (company, job, sub-account, etc) can be optional and can have variable lengths. The user specifies each component, and the software reacts accordingly, using the user's own terminology. A standard chart of accounts can be established and replicated for new jobs, product lines, companies, etc.

Reporting structures can be established independently of the Chart of Accounts sequence. Enquiries can be made of accounts and groups of accounts. All details of postings are instantly available down to cheque number, date and payee.

Subsidiary ledgers are updated online and the user controls when the details flow through into the general ledger. Each journal in each subsidiary ledger is controlled separately. For example, within accounts receivable, cash receipts can be closed after sales or vice versa. This is the case both at period end and year end.

Any number of budgets may be created and reported, or developed from current year, previous year or other budgets. Factors may be applied to reflect growth and inflation. The Pick spreadsheet can also be used as an aid in budget creation. Relational structures can be defined so that budgets may be reworked by changing key numbers such as sales. Seasonal trends can be defined to reflect working days, sales patterns and award increases.

Both formal statutory reports and management information reports are defined. The following categories of reports are available: end of month status report; transaction registers; journal reports; hierarchy reports; general ledger reports; audit ledger reports; financial reports; budgeting reports; and accounts allocation reports.

Accounts Payable There are no restrictions on the vendor code format, the number of dissections per invoice or the number of invoices per creditor. Prompt payment invoices and cheques for one, month can be processed before the previous month is complete.

GPAC can process multiple companies, each with multiple bank accounts and/or multiple Payables Control Accounts. Payments in foreign currencies are supported.

Individual dissections may be marked as Fringe Benefits Tax applicable and supplemented with notes. The subsequent report may be of great assistance in the preparation of FBT returns. Payment in foreign currencies is fully

automated. A variety of cheque formats is available, including separate remittance advices. Part payments, retentions and prescribed payments tax are fully supported.

The following reports are available: vendor report by name, account number and location; daily purchases; daily adjustments; daily cash disbursements; purchases; payables; payable's adjustments; cash disbursements; aged trial balance; A/P monthly activity summary; vendor open transaction; closed transaction; cheque review; projected payables; and A/P Work in Progress in/out.

Accounts Receivable Each customer account in the Receivables Module can be either balance forward or open item. The terms available to customers allow a nominated payment day for 30 day terms other than the end of the month, as well as the usual options.

Like the other GPAC modules, the price includes customisation of the software so as to print on stationery currently being utilised by the company. This is in contrast to some other packages, which seem to have been written by stationery vendors rather than accountants.

Reports include customer report by name and account number, daily cash receipts, daily adjustments, cash receipts, adjustments, aged trial balance and balancing and integrity.

Conclusion

The Pick operating system gives unique features to GPAC, including a clear hardware upgrade path all the way from PC AT to mid-range system, easy report generation and integration with other Pick applications. Enhancements to GPAC are easy to make, and to a certain extent are self-documenting.

GPAC appears to be an ideal solution for businesses whose needs are con-

GENERAL ACCOUNTING COMES TO UNIX

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FBS Harmony, 4GL, a professional multi-user accounting and business management system, is now available under Unix 5.3. This means that you can install FBS Harmony now and, should you change computers as your business grows, your software will grow with you.

Feature for feature, you'll find FBS Harmony is way ahead. Our multi-user software is designed to run under Unix, the world's most advanced and widely used multi-user operating environment. FBS Harmony will run on literally hundreds of different computers, ensuring you a powerful and stable upgrade path into the future.

Some of the features:

- **Multi-Company Multi-Cost/Profit Centre**
- **Open Item/Balance forward per Debtor/ Creditor.**
- **Powerful System-wide Namekey (Codes) Lookups.**
- **Full Sales Tax Processing.**
- **Up to the Minute Gross Margin Analyses over any period (even per day)**
- **Powerful Flexible Sales Order/Invoicing/ Purchase Order functionality.**
- **Colour/Batch/Size options on all Inventory items.**
- **Flexible decimal point handling per Inventory items.**
- **Flexible Forms generator to allow you to design your own Invoice/Statement/ Remittance Advice/Cheque layouts.**
- **Fully Integrated.**
- **Currency Conversion in Purchasing/ Creditor processing.**
- **Full Serial Number Processing.**
- **Powerful Flexible Invoicing.**

Sales Quotations
Sales Ordering/
Invoicing/Reporting
Debtors & Reports
Inventory & Reports
Purchase Ordering
Creditors & Reports
General Ledger &
Financial Reports
Asset Register
Rental/Evaluation
Point of Sale
Bill of Materials
Job Costing
Prospecting

For further information contact Joanne on:
(02) 957 4226 or fax:(02) 923 2570

COMPUTER ADDITIONS
HIGH END PERIPHERALS

stantly changing and growing. Because of its flexibility, it seems to be capable of modification to suit many businesses.

Harmony

Future Business Systems develops specialist software throughout Australia. Harmony has been designed to be portable across a wide range of hardware options. Its construction under the C language makes it a versatile package, which can be adapted to Xenix or Unix environments. Future Business Systems (FBS) has catered for a wide variety of screens and keyboards by supporting multiple terminal types and programming user-selected keys for keyboards.

The standard accounting suite centres around general ledger, creditors, debtors and inventory, but the modules of sales order/invoicing and purchase orders should not be excluded as core modules by the serious user. The system operates in an online, real-time environment, and as such could disappoint the user who prefers a batching control procedure for transaction entry.

The software uses impressive windowing, and of particular appeal is the ability to employ multi-tasking techniques to access another part of the suite without leaving the section currently being worked on. This is helpful, for example, when a creditor rings with a payment query, and you are in the middle of entering debtor invoices. It is very simple to 'flip' into the creditor maintenance screens, access the required information, and return directly to the debtor entry screen without harming the debtor transaction currently under entry.

Other features which may be minor, but which all add to a user-friendly and powerful system include the ability to move between menus with immediate response, and the inclusion of a number on the top right corner of the screen which corresponds directly with a printed manual reference number, making manual lookup simple.
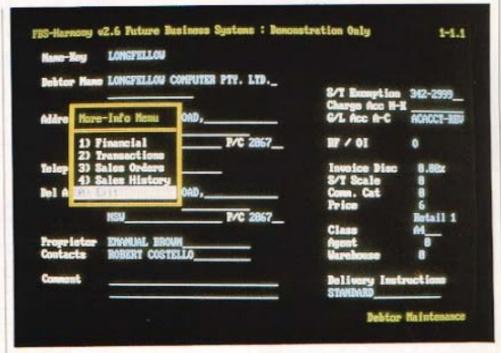
The system allows wildcarding in any indexed field. For example, all debtors that start with AM could be looked up by keying AM*; this would produce debtors such as AMPOL, AMCOR and so on, ready for immediate selection when the appropriate debtor is located.

Review of modules

General Ledger The General Ledger is integrated with the other modules in the Harmony suite, but will not accept data from subsidiary ledgers until requested by the user — a good control feature.

The ledger is constructed around a flat

Harmony allows you to call up additional textual information while still in a file

chart of accounts with no hierarchical structure. However, this potentially disastrous situation is saved by the flexibility within the 10-digit account code. The levels of reporting and selective consolidations required can fit into this code in any way. For organisations that do not have complex reporting levels — for example, department/branch/company — this should not be a disadvantage. However, when a divisions/companies/group situation is also required, we can see a problem with the sheer size of the structure fitting into a 10-digit code sequence — keep in mind that you still have to fit the account number in there somewhere!

The reports maintained with the ledger include a sufficient audit trail, transaction ledger, chart of accounts and various standard financial profit and loss and balance sheet reporting. In test mode there is a powerful report generator capable of building reports from your base of data, and extending the data with analysis and extensive calculation and selection ability. The ledger is supplied with a standard chart of accounts — a useful starting point for many businesses.

We were impressed by the amount of detail on-screen when performing an account enquiry. FBS is currently providing a utility which allows on-screen display of any report in the system, for those not requiring a hard copy.

Accounts Payable As in the General Ledger, a 10-digit code is available, which can be either a short version of the name or a number.

The module integrates fully with both General Ledger and Inventory, and individual creditors can be defined as either open item or balance forward, allowing the user to regulate the level of control over the ledger.

We were again impressed with the level of on-screen enquiry available, and this module allowed four different screens consisting of creditor base information, financial information, all current transactions and their allocation status for payment, and purchase history.

A useful feature within Creditors is the ability to record the discount terms available and also the payment terms arranged for that creditor. The system then allows the payment of invoices based upon the discount terms date or the in-house terms date, depending on whether the user wants to take ad-

At a glance

Harmony
Supplier: Future Business Systems
Tel: (03) 523 9211
Price: Per module: User system, $1680; 8-15 users $2480; 16-31 users, $4200.
Requires: 3Mbytes RAM. 100Mbyte hard disk, Unix.
In short: A full-featured accounting system for the Unix environment that is suitable for both micro and minicomputers. Flexible and capable software, in addition to being easy to use.

vantage of discounts offered by suppliers.

Audit trails to transaction level are maintained and cheques can be computer-generated for both prompt payment and creditor cheque-run situations.

Accounts Receivable The Debtors Module also supports open item and balance forward status, and is fully integrated with the General Ledger.

There were two omissions from this module we noted — the software does not have the ability to automatically charge interest on overdue accounts, and it only allows for one delivery address per debtor. Invoices are more commonly entered within the Sales Order/Invoicing Module, making that module mandatory for any user with a large volume of transactions, although it is possible to manage with Accounts Receivable alone.

The method of posting receipts to an invoice is the easiest seen yet — after entering the receipts, simply scroll up and down the invoices listed on the screen, and allocate the receipt amounts until all transactions show zero allocation required.

Sales Analysis capability again requires the Sales Order Module, which really should be seen as a further extension of the Debtors Module.

Sales Order and Invoicing As discussed earlier, this module is an integral part of the system and allows entry of sales orders and flexible invoicing. The system has its own forms generator which allows users to design their own forms, or with a bit of luck, match the system to the forms currently in use.

Features such as reprinting sales orders or invoices without the need to re-key the transaction, and profitability reporting in addition to the sales analysis reports are available.

Inventory Control The Stock Module has a number of very pleasing and rare features — serial number processing; colour, batch and size options; 12 prices per inventory line item; and five costing methods, including FIFO. The module integrates with all other relevant Harmony modules and provides stocktake procedures, price lists, re-order level reporting and multi-warehouse facility.

Purchase Order This module provides flexibility similar to that of the Sales Order Entry, with the provision of a forms generator and ease of reprinting, plus a few more options. Currency conversion is available for imported orders, and purchase ordered items can be reserved for specific sales orders — two features commonly asked for, but rarely available in accounting software.

Conclusion

We were impressed with the Harmony suite. It has the richness of features and the base of C and Unix to give users confidence in its ability to grow with the changing world of computers and technology.

An increased commitment from FBS in the support and after sales service area is desirable, as the potential of the product is such that a formal support and hotline division within the company may soon be necessary.

The software stood up to our tests very well. Watch for it in the Unix market and include it as one of the serious contenders on your shopping list if you are searching for a multi-user solution for your medium to large organisation.

Horizon

Horizon is a best-selling package with a large user base and dealer network. It is easy to use and is backed up by an experienced support team. However, it is limited in its applications because its General Ledger and Cash Book Modules are single-user, although they can be integrated with the other multi-user modules. Account codes are also limited to four numeric characters. Horizon will run on both single and multi-user operating systems including CP/M, DOS and Concurrent DOS.

The second edition of the manuals is impressive and has a high standard of presentation. Helpful features such as a 'Let's Practise' section walk the new user through the important parts of each module as each screen displays the appropriate manual page number.

Although Horizon was a best seller, it is now having difficulties competing with the more flexible packages written in 4GLs which are adaptable to a variety of popular operating systems.

Review of modules

General Ledger The Horizon account code consists of eight digits, including a four digit sub-account. The ledger comes with a standard Chart of Accounts or you can create your own. You can also create your own reports, and enter monthly budget figures for last year and the current year.

Information can download easily into other applications such as Lotus and dBASE.

Accounts Payable Allows balance brought forward or open item accounts. A graphics facility allows the user to dis-

```
LOGON ** Horizon Series - Menu [S471215]                    18/11/88

1.  Accounts Receivable          9.   Reporter

2.  Inventory Control            18.  Breakaway

3.  Sales Order Entry

4.  Accounts Payable

5.  General Ledger

6.  Cash Book

7.  Job Costing

8.  Bill of Materials


Select (P.asswords, D.ate, E.xit) *-/
```

Horizon's General Ledger and Cash Book are single-user modules; however, they can be integrated with other multi-user modules

play and print purchases and other figures in chart form. However, we could find no mention of this feature in the manual.

Accounts Receivable A mini word-processing facility with this module allows the user to produce form letters including late payment reminders, product release information and other sales data.

Invoices can also be formatted to a size suitable for the user's needs. Customers can be invoiced on a regular basis with the automatic customer billing feature.

Sales Order Entry This module handles up to 32,000 sales orders with online order entry and inventory integration. The

system also caters for partial shipments and multiple invoicing of each order.

The Order Status Facility allows the user to analyse at any time orders received, inventory levels, inventory pricing and shipping details.

Invoices, packing slips and sales orders can be customised to suit the requirements of the organisation.

Inventory Stock Control This module allows the user up to 15 characters of alphanumeric code to identify items of inventory. It feels disjointed from the rest of the package and does not integrate with the general ledger.

Job Costing This module is divided into two sections: WIP and master jobs. The WIP jobs are the core of the system, whereas master jobs are to be used as templates. Job descriptions can also be copied to reduce job creation time.

Unlisted stock items can be added through this module and stock can be flagged as either diminishing or non-diminishing.

Cash Book The Cash Book Module can be used as a standalone system to record all income and expenditure. It can be integrated with the other modules to monitor the cash flow of each category of income and expenditure. A maximum of nine separate bank accounts can be maintained and a bank reconciliation report can be produced.

Conclusion

Extensive appendices at the end of each manual list a glossary of terms, error

messages and their meaning, and descriptions of fields and sample reports.

Horizon is a package that has aged with the advent of 4GLs and more powerful processors. A reliable product, it has survived well against a large number of formidable opponents.

Information Business Manager

Information Business Manager (IBM) is a relatively simple package to operate and may be of most use for small businesses placing importance on sales analysis. It is fully integrated and can operate as a single-user system (BMII) or a multi-user system (BMIII) using Concurrent PC-DOS.

Business Manager is menu driven and is not complicated to install. The package prompts the user for the system parameters required to set up each module, and for individual inputs for all processing and set up of master files. The only way of observing the information in the files is by screen enquiry options.

The system is fairly standard, however there are several useful features such as a mailmerge facility which enables mailing lists to be merged with word processors.

There is no online help available, but the manual gives adequate descriptions for each input field and the system is relatively easy to follow.
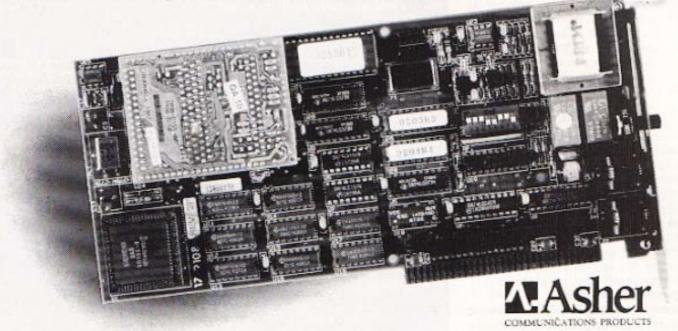
Error messages are given for both system and processing errors, however, some of the messages are not very descriptive. After entering new records in the master files you must manually invoke the sort routine before performing any type of alpha search or alpha reporting.

Review of modules

General Ledger Allows only single company processing and is easy to use. The user has the choice of either using one of the standard Chart of Accounts which includes company, a partnership or sole trader, or creating his own using the account numbers specified in the manual. Business Manager's General Ledger offers only simple general ledger processing with full integration to all other modules.

Reports are all system defined, but the user may select some reporting parameters. The profit and loss reports are divided into manufacturing statement, trading statement and profit and loss statement.

Journal entries must be entered as either one credit and several debits or vice versa so that it is impossible for one-sided journal entries to be entered. The system allows up to nine bank accounts to be maintained.

The features offered by BMII General Ledger include separate entries for journals, cash payments and cash receipts; automatic transfer of the control totals balances from the Accounts Payable and Accounts Receivable Modules if integrated; and online enquiries into account balances. BMII also enables previous-period postings and has a facility to set monthly budgets for each account. The management reports available include chart of accounts, transaction/audit list, private ledger print, trial balance, profit and loss statement, balance sheet and budgets.

Accounts Payable This is also a simple module providing control over the creditor balances. It has the facility to integrate to the General Ledger and/or the Stock System.

The features this module includes are: up to 8000 creditors with the choice of making each creditor either open item or balance forward; alpha key search; up to 999 purchase dissection codes; purchase dissection reports and enquiries for comparison with last year's figures; aged trial balance; automatic cheque printing; mailing labels; remittance advices; on-screen summary of aged trial balance as well as month and year-to-date purchases; and a password facility.

Accounts Receivable This module offers detailed sales analysis and good control over debtors. The system allocates debtor codes and will re-allocate the codes when debtors are deleted.

The module also contains the following useful features: up to 8000 debtors; facility to create invoices for both stock and services and to enter manually prepared invoices; open item and balance forward debtors; alpha search key; facility to charge interest on overdue accounts; up to 999 sales dissection codes with sales dissection reports and on-screen enquiries; user defined sales history enquiry showing all stock lines the buyer has purchased; salesperson analysis; commission reports; and the ability to generate debt collection letters with automatic outstanding balances.

Inventory Stock Control Can operate as an integrated system to both Accounts Payable and Accounts Receivable Modules or as a standalone system. The Stock Control Module can maintain up-to-date information on inventory levels, and online or batch invoices can be produced. Stock groups

```
MENU ** GENERAL LEDGER MENU  V2.06/888                        81/81/88


  1.  New chart create              9.  Transaction print - Cash payments
                                    18.  Transaction print - Cash receipts
                                    11.  Transaction print - Journals
  2.  Update chart of accounts
  3.  Print chart of accounts      12.  Private ledger enquiry
                                    13.  Private ledger print
  4.  Budget entry/amend
  5.  Budget print                 14.  Trial balance print
                                    15.  Profit & Loss print
  6.  Cash payments entry          16.  Balance Sheet
  7.  Cash receipts entry
                                    17.  Monthly ageing
  8.  Journal entry                18.  Yearly ageing
                                    19.  Dissection transfer



  Select (E.xit 0.ther)
```

IBM General Ledger allows separate entries for cash payments, cash receipts and journal entries

may be created and up to 27,000 stock lines are permitted. Posting to the Accounts Payable and Accounts Receivable dissections is automatic. Inventory also provides price lists and stock movement reports, stocktake facilities and stocktake variance reports.

Purchase Orders This is used in conjunction with the Creditors Module. It enables the entry and creation of purchase orders, allows for updating of the stock files on receipt of goods, and updates the creditors file on receipt of invoice. On-screen enquiries and printed reports of the status of orders are also available.

Bill of Materials This is used in conjunction with the stock system. It can handle up to nine levels of sub-assemblies, with each component comprising up to 20 parts. The different levels of production must be given a stock code which can be used in the production of one or more finished goods. Automatic recalculation of the cost of finished goods is based on the cost price of the components, and it updates the stock file with the new price. Production reports and requirement lists are available from the system.

Job Costing The BM Job Costing Module is used in conjunction with the Accounts Receivable and Stock Modules. Entry of the estimated labour time and the materials required in a production run enables comparisons of estimate with actual performance for each job. Production scheduling is available for booking hours or machines by date.

Automatic Billing This module integrates with the Accounts Receivable Module. It is useful for leasing and rental agreements where there are standard periodic charges. Total contract amount, deposit held, periodic charge and the frequency of billing is held by the system. Invoice printing is performed automatically during monthly billing runs.

Point of Sale This is integrated with the Stock and Accounts Payable Modules. It interfaces with a variety of cash drawers, and upon printing the docket immediately updates the stock quantities and sales analysis records and makes postings to the general ledger. Credit card and cash payment records are kept separately on file and

correct change is calculated and displayed.

Conclusion

Information Business Manager II and III are simple systems to operate and maintain. The basic package is suitable for a small to medium-sized business with relatively simple processing requirements, but it can be greatly enhanced by integration with the additional modules. A good package for simple retailing and manufacturing businesses.

Management Accounting System

Management Accounting System (MAS) is suitable for medium-sized businesses which need flexible reporting facilities and professional accounting practices. The package offers several features which are useful for detailed analysis and more sophisticated processing. There is a password facility, but it is not user defined.

MAS is relatively easy to install and the control files are not difficult to set up. The package does, however, assume and require a substantial knowledge of accounting procedures.

The package allows for multiple companies to be set up by creating new client paths with up to 1000 divisions for each company path. The system allows for consolidation of these entities.

On-screen help is available, and the manuals are fairly comprehensive if not very well organised.

One of the most desirable features of MAS is the flexible and comprehensive reporting facility. A large range of financial reports is provided, and using the freeform report generator you have the facility to tailor those reports to your own requirements and create custom reports.

Accounts Receivable and Accounts Payable are separate packages which are not directly integrated to the General Ledger. It is, however, possible to set up Creditors and Debtors in the MAS system as sub-ledgers. There is a comprehensive range of other packages which provides for a variety of accounting tools such as leased assets accounting and the task management system.

Review of modules

General Ledger The MAS system is based around the General Ledger package. Within this package it is possible to set up sub-ledgers, which is one way to process debtors and creditors. A comprehensive and flexible Master Chart of

	Mary	Larry	*Andrew	Peter	Total
Balance at 1/7/98	4000	5000	7500	2500	19000
Capital Introduced	500	600	1000	500	2600
Share of Profit	1200	1800	2000	750	5750
	5700	7400	10500	3750	27350
Less Drawings:-					
Income Tax	1400	2000	4000	1250	8650
Life Assurance	1000	1000	1500	1000	4500
Medical Insurance	700	800	2000	450	3950
	3100	3800	7500	2700	17100
Total Funds 30/6/99	2600	3600	3000	1050	10250

The Smith Family Partnership
Schedule of Partnership Current Accounts
For the Year Ended 30th June 1999

MAS allows for up to 1000 divisions within a single ledger, and up to 14 divisions may be printed in this manner

Accounts is provided with the system. You may create your own chart of accounts, but if you require the use of the formatted reports you should use the Master Chart.

The Chart of Accounts is one of the most flexible we have seen, and has an excellent alphanumeric code facility. Features include sub-accounts, budgets for values and quantities for previous, current and future years, and the facility to convert actual balances to form a basic budget. There is also the facility for standing journals, proportional journals, bank reconciliations and a daily interest calculator. Standard reports include audit trails, account listings, trial balance and tax schedules. The system can cater for inter-company consolidations and farm accounting, and it is possible to revise the number of periods in any ledger. The system has a report writing facility called freeform, which enables control over the presentation of financial statements and creation of reports. There is also a fully integrated word-processing facility to enhance directors' reports.

Accounts Payable This module is designed to operate standalone, but the system can print a full schedule of MAS journal entries for integration.

The system offers simple control over your creditors. Creditors' accounts may be either balance forward or open item, and credit terms may be specified for up to a year. Purchases may be dissected into expense categories, invoices may be allocated a prompt payment priority and discounts can be recorded. Reporting facilities include a cash commitment report, remittance advices, cheque

schedules, purchase analysis and an aged creditor analysis.

Credit Management This system offers good debtor control, however, it is not directly integrated to the MAS system. To print invoices the Invoice Module must be purchased.

Up to 15,000 debtors can be maintained, and the system allows for sales tax, discount levels and credit limits for each debtor. The module has an extensive sales analysis facility which enables reporting by area, debtor group, type or department. It can be integrated to two sub-systems — inventory and invoicing — which enables gross profit reporting. A sophisticated feature of this system is that it enables budgets to be set for customers and gives reports of trends in

At a glance

Management Accounting System
Supplier: Solution 6
Tel: (02) 906 0666
Price: Unix pricing not available. DOS version — General Ledger, $1800; including Report Writer, $3600.
Requires: 1Mbyte RAM, minimum 20Mbyte hard disk recommended.
In short: MAS is designed for use in professional/public accounting. The package is comprehensive, designed for operators experienced in accounting procedures with a need for flexible and extensive reporting facilities.

product sales. New creditors may be added while entering invoices, which is a good timesaver for many businesses.

Inventory Management This module is integrated to Credit Management. Up to 15,000 inventory items may be stored in a ledger and the stock may be valued at average, last or standard cost with up to 12 stock locations and five prices per item. Stocktaking facilities and a facility which give the suggested re-order point for stock are also available. The price revision feature allows for automatic revisions by factor, or a constant base on the average, last or standard cost. Reports include stock valuations, movements, critical levels and unrealised profit reports.

Cash Book This package is used for cash flow reporting by entering deposit slips and cheque requisitions. Cash Book allows for optional printing of cheques and has the facility to perform bank reconciliations. Remote cash book processing and central financial accounting is also possible.

Asset Register The Asset Register caters for both tax and company depreciation, and profits or losses made on sales of assets are automatically journalised. Other features include options for private use, depreciable limits and capital gains calculation. Sales of assets may be reversed, profits on sales may be offset against other assets, and assets can be broken down into sub-assets and location of assets. An assortment of depreciation methods is catered for including prime cost, diminishing value, timesharing, usage and immediate write-offs.

Investment Register This module can be fully integrated to the MAS system and caters for profit/loss calculation on the sale of shares. The investment register may contain information about quotations or exchange listings. A full investment schedule is provided showing opening share value, year-to-date pur-


```
                    SYBIZ PLUS SAMPLE DATA

ENQUIRY  - USED TO VIEW ANY ACCOUNT OR TRANSACTION

TRANS    - ORDERS, INVOICES, CASH, TRANSFERS, ETC.

REPORTS  - REPORTS, STATEMENTS, DISK DUMP, LABELS, LETTERS

MAINT    - OPENS LEDGERS & OPENS, EDITS OR CLOSES ACCOUNTS

LOG      - PRINTS TRANSACTION AUDIT TRAIL (terminal 1 only)

UTILITY  - NEW PERIOD, REBUILD, TABLES AND SYSTEM DETAILS

FINISH   - SHUTS DOWN THE SYSTEM
```

| VIEW F1 | CALC F2 | ENQUIRY F3 | TRANS F4 | REPORTS F5 | MAINT F6 | F7 | F8, ↵ | UTILITY F9 | FINISH F10 |

Rev.1

SELECT THE REQUIRED OPERATION

Sybiz requires selection of menu items by function keys. The functions are written across the bottom of the screen with the menu above

chases and sales, closing shares, dividends received, profit or loss on sales and a market valuation.

Cheques List The Cheques List Module enables the bank statements to be entered into MAS, which shows them in cheque sequence for easy coding. This allows the dissection of cheques and the insertion of outstanding cheques.

Disk Filing and Reporting This module facilitates the importing of transactions from other sources and other Solution 6 packages into the MAS system. It also allows reports from the MAS system to be stored on disk and modification of these reports using a word-processing or spreadsheet package.

Leased Asset System The Leased Asset system is a standalone package designed to provide information and reporting details for financial leases held.

Task Management System This is an integrated billing system designed for managing clients, assignments and employee time. It allows for budgeting and planning of tasks, and for each employee to have up to three charge rates and hourly costs.

Practice Management System This is an advanced version of the Task Management System which allows for time costing. It integrates with the taxation system and the MAS. There is a variety of modules which integrate to the PMS including resource planning, mailing, corporate affairs, marketing, office management and an employee register.

Conclusion

MAS is a popular package within professional/public accounting. It has sophisti-

cated features particularly when used in conjunction with the optional modules and when used with the Freeform Reporting Module, which provides for flexible and useful reporting facilities.

Sybiz Accounting Plus

Sybiz is an integrated accounting package which is easy to install. The screen layout has a different arrangement from most other accounting packages. Instead of arranging the menus by modules, it organises menus by process types, which means moving around the various screens for processing within the one module. However, the view function available on every screen enables you to view any account in the system from

any screen — if you know the account number.

All selection of menu items is by the function keys. The menu function or process, which will be actioned by each function key, is written across the bottom of the screen with the menu above. As each program is brought in, various parts of the screen flash to highlight the activity.

The manual — which is organised by process type rather than ledger type — provides brief documentation for system processing and individual screen items. There is no online help documentation.

A maximum of 16 ledgers, may be created and they can be any combination of general ledgers, debtors, creditors, inventory and job costing. It is possible to

set up unlimited companies through the use of DOS and pathing of the data files.

Another useful feature is the password facility at system level and for the General Ledger Module. Also, an on-screen calculator facility is accessible at any time for simple whole digit calculations. There is a facility to store keystrokes in system macros, which is particularly useful for monthly printing of a sequence of reports.

Review of modules

General Ledger The user has the choice of running the simple general ledger or the extended general ledger, which enables extra items to be stored. Set up of accounts and processing is relatively simple and the system will indicate if journal transactions have not balanced.

Sybiz Plus General Ledger facilities include budgets for the month and year-to-date, current balance and closing balance last year, and the opening balance for transaction history. There are separate functions for receipts, payments and journals, and up to 64 standing journals. If the extended general ledger function is selected, the system also stores the current balance of an account 13 months ago, the movement in the account during each of the last 12 months and the budget movement for each of the 12 months of the year. Reports include trial balance, a trading profit and loss statement, balance sheet, transaction histories and an account list.
Accounts Payable This module gives detailed creditor control and is able to enter creditor terms. Currency details can be stored for suppliers but there is no multi-currency processing facility.

Some of the outstanding features of the Sybiz Accounts Payable package include discounts for on-time payments, purchases for the month-to-date and year-to-date, creditor terms, date and amount of last payment, currency details and open item or balance brought forward creditor balances. The Creditors' Module also caters for entry of supplier invoices, credit notes and dissections to the general ledger, inventory or jobs. Cheque and remittance advice printing is optionally available. The reports consist of aged balance list of active accounts and aged balance list of overdue accounts, withholding tax monthly return, future payments, transaction histories for active accounts, remittance advices/statements and mailing labels.

Accounts Receivable This module is relatively easy to use and set up. It offers good control over debtors and has the option of being automatically integrated to the general ledger and inventory.

The Sybiz Plus Debtors Ledger facilities include credit limits for debtors, prompt payment discounts, two classes of discount percentages, date and amount of last receipt, current 30, 60 and 90 day balances, and month and year-to-date sales value. Invoices with up to 22 lines, manually prepared invoices and credit notes may be dissected to the general ledger, inventory or jobs. A sales analysis of 64 codes is provided on all invoicing. Receipts may be entered with automatic aging or with manual selection of aging.

Reports include aged balance list of active accounts, overdue accounts, customers over credit limits, transaction histories, monthly statements, sales tax analysis, sales analysis, itemised list of outstanding orders by customer, mailing labels and a status report of all ledgers.

Inventory The Sybiz Inventory Module is integrated with accounts payable and accounts receivable and job costing. Features include three price levels, 16 sales tax levels, three discount classes, reorder levels, gross value at average cost, supplier's lead time, quantity on customer order/backorder, year-to-date and month-to-date quantity sold and gross profit. Goods inwards and outwards transactions are processed through the payable and accounts invoices.

Job Costing This module combines Job Costing and Work in Progress into the one ledger. It is integrated with inventory and accounts payable. Transactions available include posting of labour from timesheets, transfer of materials to and from inventory, purchases of sub-contract and bought-in items, claim processing and journal adjustments to write off

unbilled work in progress. The reports provided include summary and detailed reports of job status, cost analysis, transaction history, cost centre analysis within each job and a staff utilisation summary.

Advanced User Module Advanced User can be used to link Sybiz to other packages such as spreadsheets, word processors and databases for further manipulation of data.
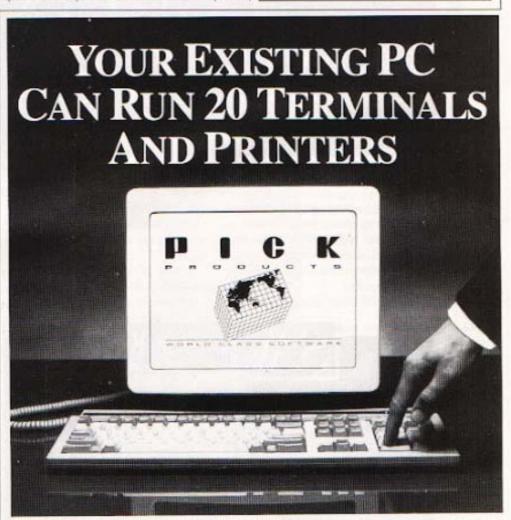
Report Generator This can be integrated with Sybiz and enables the user to create up to 40 customised reports for any of the ledgers. Using the Report Generator, it is possible to produce consolidated reports

for a multi-company environment covering more than one ledger.

Conclusion

Sybiz has been a popular package within Australia for a number of years. It is suitable for small businesses and has the facility to run as either single or multi-user. It can be enhanced by integration to other Sybiz packages such as Bill of Materials and Payroll to suit a manufacturing environment, and to the Report Generator and the Advanced User Module.

END

Lies, damned lies, and spreadsheets

Lend credibility to your computations by using these five simple validity tests. Ronald Pearson shows you how.
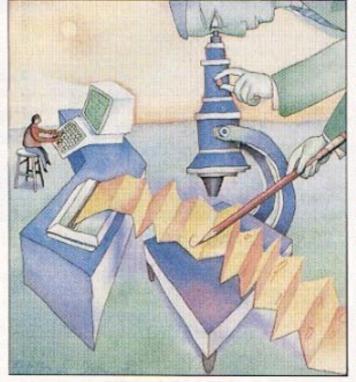
Mark Twain, in his autobiography, credits Benjamin Disraeli with identifying the three kinds of lies as 'lies, damned lies, and statistics'. While statisticians are professionally obligated to take umbrage at this remark, it does neatly summarise the level of public trust in a lot of numerical data-analysis procedures, statistical or otherwise. Careless application of these procedures to great piles of incomprehensible data can lead to some real problems. What appears on your display as output is not necessarily truth, as the following tale of statistical woe illustrates.

The case of the conflicting counts

A large professional organisation once surveyed its members on a variety of topics. One of the questions on the poll was "Did you vote in the last society election?" When the responses to this question were compared with the actual voting records, the pollsters noted a large discrepancy — the percentage of respondents who said they had voted was significantly larger than the percentage of society members who actually had voted. After careful examination of the data, the survey team advanced an awkward explanation for the difference.

Most opinion polls attempt to reach as many members of the group being surveyed as possible so the conclusions will accurately reflect the group's opinion. In this case, the analysing statistician claimed that the number of surveys returned was large enough to yield statistically significant results. One pertinent issue, however, was whether or not this collection of members was representative. It may not have been.

One variable that may have influenced the results was that ballots had been mailed to all society members with stamped, self-addressed envelopes included. In contrast, the survey questionnaires were placed at the back of the monthly society newspaper that is mailed to all members.

Those who took the trouble to fill out the questionnaire were probably more involved in society activities (and, therefore, more likely to have voted in the election) than those who did not fill it out. This kind of analytical faux pas is more common than most would like to admit.

There is a way you can steer clear of these kinds of problems and see to it that when awkward explanations are called for, somebody else is making them. ("Well, sir, according to my financial forecast, we were expecting a profit of $6 trillion from the new electric shoelaces we introduced this quarter, but there seems to be a bug in the program or something . . .") You can apply five simple validity tests to your data immediately after you evaluate your information. These tests are based on the fact that most data-analysis procedures take a large set of relatively uninformative numbers (the raw data) and boil them down to a small set of much more useful numbers (final results).
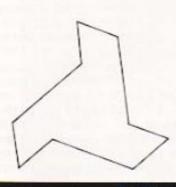
The five validity tests

• *Are the results impossible or unreasonable?* Sometimes, raw data is so corrupted with measurement errors or missing data points that your data-analysis package generates suspiciously unreasonable numbers. Similarly, if you use a computational method outside its range of validity (eg, curve fitting with only one data point), bizarre numbers can result. Generally, however, these results do not warn you that there is a problem (eg, 'Caution: the following results are numerical drivel and have no basis in fact. Ignore them'.)
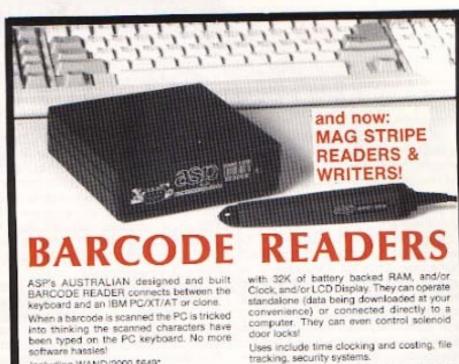
If the analysis is complicated enough, faulty results will not necessarily be 'intuitively obvious even to the most casual observer'. By Murphy's Law, however, they will come to light at the worst possible time. Then you may find yourself explaining to the founder and MD of your firm why the percentage of total sales broken down by market segments totals 312 per cent, or why the total number of widgets sold in the previous month is less than zero. Mistakes of this sort are easy enough to make by hand, but they are much more memorable after they have been turned into multi-colour presentation charts by your integrated spreadsheet/word processor/slide-maker package.

• *If possible, estimate your results by some other method — then check to see if both answers are in reasonable agreement.* Often, you can estimate some or all of the results you are calculating by another, possibly cruder, method. Typically, these secondary estimates are only approximate, but frequently they can provide at least order-of-magnitude figures as checks on your primary results. If the primary estimates are wildly different from these secondary estimates, a careful re-examination of both results is probably in order. While such disagreements do not necessarily mean that your computations are in error, they do suggest that you should seek a reason for the discrepancy before you stake your career on either estimate.

• *Do small changes in your raw data values cause enormous changes in your results?* Extreme sensitivity to small changes in the starting data may indicate difficulties with either the problem itself or the computational method you are using to solve it. While both of these difficulties can result in hypersensitivity, their implications are quite different.

A problem is said to be ill-conditioned if small changes validity the starting data cause large (albeit accurate) changes in the results.

However, a numerically unstable com-

putational method could also cause this sensitivity to small changes. The difference is that here, the results are probably wrong. Change to a more stable method.

• *Do large changes in the raw data cause little or no change in the results?* If you see no change in the results when you change your raw data, you probably have trouble. As in the case of overly sensitive computations, it could be that the problem you are trying to solve really is highly insensitive to changes to the raw data; but in most problems, that's not the case. Thus, as in the case of extreme sensitivity to small changes, extreme insensitivity to large changes should be investigated.

It is more likely that such insensitivity means that some intermediate result has underflowed or overflowed, or has been erroneously multiplied by 0 or subtracted from itself. Such problems could arise either from bugs in the computational software or from using a particular computational method outside its range of validity. In any event, the end result is that, no matter what raw data you feed it, you are getting the same (wrong) answer every time you do the calculation. Be especially suspicious if your

computations consistently yield the same magic number, like 0, π, or a power of 2.

• *Examine the raw data graphically and numerically — do any of the data points look suspicious?* An annoying feature of real data is that it sometimes contains outliers — bogus data points. In manually entered data, this problem can arise from transposition errors or other simple human mistakes in recording the information. In computer-collected data, the problem can still arise if the input range of the sensors collecting the data is momentarily exceeded.

The point is that any collection of data from the real world — no matter how it was acquired — can contain one or more bad observations. Typically, these bad observations represent large (rather than small) deviations from what the real data should be. Since some common computational techniques (ie, least-squares curve fitting) are fairly sensitive to the presence of outliers, it is important to check for the presence of outliers in the raw data. This analysis can often be done graphically: when almost all the data points conform to some pattern (especially a pattern you are expecting), the few that stick out like a small en-

semble of sore thumbs may well be outliers.

The best procedure for confirming that a suspicious data point is indeed an outlier is to go back to the source of the data and double-check to see if there was some error in data collection. If this is not possible, or if the results of the check are inconclusive, it would probably be best to recompute the results either with a more reasonable estimate of the suspicious data point or without it altogether.

You should be careful here, however. Don't discard a significant portion of your data as outliers. Ideally, an outlier should be a single, isolated observation in the middle of 20 or more good observations. If the data point really is valid, removing it and re-doing the calculations shouldn't change the results much; large changes suggest that the point in question is an outlier. However, if one point, even a good one, is removed from a set of only three or four, large changes are apt to occur.

A hypothetical case study

Let's use these validity tests in an example. Suppose your boss asks you to find a reasonable approach to forecast-

	A	B	C	D	E
1	Example 1		Inventory	Forecasting	Absolute
2	Month	Inventory	Trend	Error	Error
3					
4	1	23700	18524.1026	-5175.8974	5175.89744
5	2	25400	21352.1445	-4047.8555	4047.85548
6	3	2940	24180.1865	21240.1865	21240.1865
7	4	31300	27008.2284	-4291.7716	4291.77156
8	5	33700	29836.2704	-3863.7296	3863.7296
9	6	35000	32664.3124	-2335.6876	2335.68765
10	7	38100	35492.3543	-2607.6457	2607.64569
11	8	39800	38320.3963	-1479.6037	1479.60373
12	9	41700	41148.4382	-551.56177	551.561772
13	10	43200	43976.4802	776.480186	776.480186
14	11	46100	46804.5221	704.522145	704.522145
15	12	48000	49632.5641	1632.5641	1632.5641
16					
17	Average:	34078.3333	34078.3333	-6.063E-13	4058.95882
18		Test 4:		Test 1:	Test 2:
19		Change month 3		Unreasonable	New method
20		29400	(no real	6.0633E-13	480.06993
21		vs. 2940	change)	-6.063E-13	4058.95882
22				"Zero"	"Reasonable"

Fig 1 In this hypothetical Excel spreadsheet example, columns A and B show the dollar inventory amounts for the preceding 12 months

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EPSON 40 Mb v. coil H/disk ADD $440

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Microsoft Works	$289
Microsoft Windows	$155
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ing your company's monthly widget inventory in dollars. Your general impression is that this inventory has been steadily growing, so it could probably be predicted reasonably by extrapolating from the last few months' numbers.

To test this hypothesis, you set up the Excel spreadsheet shown in Fig 1 and enter the dollar inventory amounts for the 12 months of last year (columns A and B). With Excel, you can fit a straight line to this data using the built-in Trend function. The results of this fit are listed in column C. A colleague has suggested that you evaluate the quality of this fit by computing the prediction errors (ie, the value predicted by the Trend function minus the true value from column B) and averaging them to get an average prediction error. Column D contains these forecasting errors, and the average value of all the columns is listed at the bottom of each column.

Applying validity test 1, 'Are the results unreasonable?', it's clear that something is wrong. Specifically, the dollar amounts in the actual and predicted inventory columns (B and C) are in the tens of thousands of dollars, while the average forecasting error at the bottom of column D is $-6.063E - 13$, or zero for all practical purposes.

Because the average prediction error is zero, it looks as if the results indicate the Trend function has predicted the inventory values perfectly. The difficulty is that the Trend function generates a least-squares linear fit that exactly splits the difference, trading off positive prediction errors on some points for negative prediction errors in others. Consequently, regardless of how well the line actually fits the data, the average prediction error computed here is always zero. Thus, the small number computed by the spreadsheet is just round-off error.

A more reasonable indicator of the calibre of the Trend function fit is the average of the absolute values of the prediction errors, tabulated in column E. This average is just a little over $4000, a figure that represents about 8.5 per cent of the average inventory for the year, suggesting Trend fits the data reasonably well but not perfectly. Comparing this average with the average error computed from column D, the second validity test again suggests that the average error in column D is not representative.

Skipping ahead to the test for outliers, Fig 2 shows an x,y plot of the monthly inventory data. Note that all the points except the third lie fairly well on a straight line. The third point, however, clearly is much too low, a discrepancy that suggests it may be an outlier. Rechecking this number, 2940, against the others in

Fig 2 The third point of the x,y plot of the monthly inventory data is out of sync with the rest and thus may be an outlier
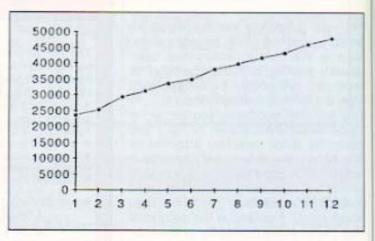
Fig 3 Inserting the correct figure for the third month yields an x,y plot with a much straighter line

column B, we become even more suspicious — all the other numbers are in the tens of thousands of dollars and are expressed as even 100s.

The simplest possibility is that a trailing zero has been dropped. Perhaps this entry should read 29,400 instead of 2940. Inserting the larger number for the third month yields the x,y plot shown in Fig 3, clearly a much better straight line. This revised calculation can also be viewed as the fourth validity test: 'make a large change in the data and look for extreme insensitivity'.

As expected, this change in the data improves the average magnitude of the prediction error (column E), reducing it from about $4000 to just under $500. In terms of the average monthly inventory, this replacement of point three with a more reasonable number has reduced the average absolute prediction error from about 8.5 per cent to just under one per cent. The average prediction error computed in column D, however, remains effectively zero, changing from −6.063E − 13 to +6.0633E − 13, a result that again suggests that this quantity is independent of the data and thus not useful.

While examples failing the third validity test (ie, extreme sensitivity to small changes in the data) do not arise as commonly, they do appear often enough to be worth checking for. To illustrate this point, consider the spreadsheet shown in Fig 4. Here, warehouse storage charges are given for 12 months (column C), together with the dollar value of the widget inventory stored there (column B). Suppose you assume that these two quantities are related, and your boss wants a number he or she can quote as to how many cents per dollar of inventory it costs to store your gizmos.
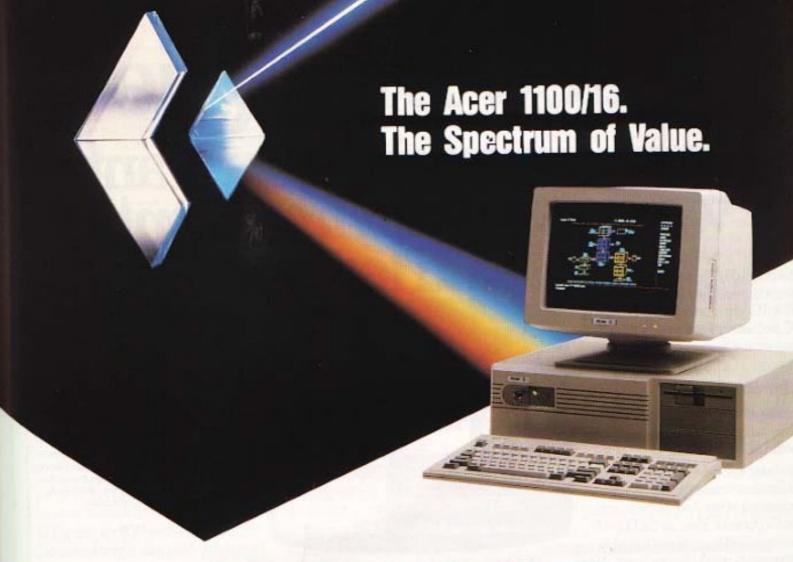
Using Excel's built-in Linest function, you calculate the first set of numbers shown for slope and intercept of the best-fit straight line through the data.

	A	B	C	D	E	F
1						
2		Example of Extreme Sensitivity:				
3			1% Change in C18 Causes 454% Change in Answer			
4						
5	Month	Inventory	Storage Fee			Perturbed Fee
6						
7	1	10300	101			101
8	2	12400	103	Linear fit with original data		103
9	3	14500	98			98
10	4	15700	105	4.3409E-06	101.741848	105
11	5	19000	104			104
12	6	20400	100	Linear fit with perturbed data		100
13	7	22500	100			100
14	8	23900	105	2.4068E-05	101.409433	105
15	9	25800	100			100
16	10	27700	104	Percent changes		104
17	11	29400	100			100
18	12	31300	102	454.444444	-0.3267243	103
19				Slope	y-axis intercept	

Fig 4 Column C shows the warehouse storage charges for 12 months, while dollar values of the stored inventory are shown in column B

From there, you can easily generate your boss's desired number. But first, just to be on the safe side, you apply test three to the data, adjusting the last storage cost by one per cent. Your results show that this insignificant change in one of 12 numbers changes your final result by 454 per cent.

Even worse, you change that number back and make a one per cent change in the first month's storage fee, and the *sign* of your number changes — apparently you would save money by storing more goods. Either you have discovered some hitherto unknown loophole in the physics of warehouse management or, more likely, you have discovered a problem with your calculations.

The problem is that, regardless of the value of the widget inventory you are storing, it seems to cost about $100 per month to store them. Thus, the linear connection you are trying to make between the inventory dollar value and storage fees simply does not exist. The small numbers you are computing for the slope of the best-fit straight line through the data, are really trying to tell you that no such relationship exists — the slope of the line is about zero. The apparent extreme sensitivity is due to the fact that almost any change in something that is about zero is going to amount to a large percentage of that something.

Caveat emptor

The tests I've described for unearthing analytical blunders are only a few of many possibilities and, sadly, are not guaranteed to turn up all your potential computation flaws. That is, significant errors can

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'In more real-world examples with huge spreadsheets, obvious inconsistencies between the entries in cell A1 and ZZ312 may not be easy to spot.'

---

exist in computations that pass all these tests. Conversely, even some perfectly valid results would look suspicious under one or more of these tests. There will even be some cases where all these tests either are inapplicable or return inconclusive results. Overall, however, if you can apply them, testing your results is a lot better than the alternative of doing nothing and hoping for the best.

While it could be argued that the actual spreadsheet examples described here illustrate blunders that were intuitively obvious to the most casual observer, such errors often appear that way only after they have been discovered. I deliberately simplified these examples to illustrate what was going wrong and how these five validity tests can alert you to the problems. In more real-world examples with huge spreadsheets, obvious inconsistencies between the entries in cell A1 and ZZ312 may not be easy to spot.

Keep in mind that the results of any computation are only as good as its most questionable step. This point is neatly illustrated by "Burns' Hog-Weighing Method," generally attributed to Scottish poet Robert Burns:

1. Select a well-balanced board and place it symmetrically on a fulcrum.
2. Place the hog to be weighed on one end of the board.
3. Pile rocks on the other end of the board until they exactly balance the weight of the hog.
4. Carefully guess the weight of the rocks.

END

WordStar 5

WordStar is 10 years old and starting to show its age, but Steve Mansfield believes that, with the new version 5, MicroPro has pulled the program into the late 1980s.

WordStar simply refuses to act its age. The old faithful word processor is 10 years old, and in many ways has started to look it. It has taken some serious knocks from the competition, with the latest incarnations of WordPerfect and Microsoft's Word making WordStar look positively stone-age.

Yet MicroPro isn't giving up yet. The new version of WordStar Professional — release 5 — has given the program a much-needed facelift. Many of the enhancements are simply WordStar catching up with its competition, but some of the changes are more than cosmetic.

Familiarity may breed contempt, and there are plenty of people who won't go near WordStar, but it's the past popularity of the program that helps keep it alive. Other text editors boast of compatibility with WordStar commands, however arcane they may be, because there are so many fingers out there trained to behave that way. Users and companies are reluctant to invest the time and trouble, not to mention money, to retrain for another word processor.

Visual improvements

With version 5, MicroPro has tweaked some of the features, seriously enhanced others and has thrown in a whole bunch of new ones. The company, not unnaturally, is putting the emphasis on some of the new version's more visual improvements. These include drop-down menus, automatic reformatting of text, page preview and multi-column formatting, which look good in the demos and sound good in the literature. There are no less than 300 enhancements to version 4 (which had a similar number of upgrades over the previous version).

Apart from some snazzy new graphics, the packaging is comfortably familiar. The box contains the disks, function key templates, a quick-reference command booklet and the usual registration cards and promotional literature. The single manual is now perfect-bound, rather than ring-bound. Presumably the fact that it won't stay open at your chosen page means it is also difficult to hold flat on a photocopier.

As is inevitable with any new version of WordStar, the disk count has increased. WordStar 5 comes on twelve 5.25in floppies — the 3.5in version has yet to be released. Installation on a hard disk is a simple matter of creating a new directory and copying the files into it. Alas, there is no information about which files can be safely deleted if you don't want, say, PostScript support. Once everything is copied over, apart from the tutorial files, the program occupies a little over 3Mbytes of disk space. I would suggest that people without hard disks should start thinking about alternative word processors.

You can run WordStar straight from the box, but most users will want to modify it at least a little. This is done the normal WordStar way by running the WINSTAL program to set the basic system parameters — screen and printer type, disk configurations and so on — and then using the WSCHANGE program later to fine tune the program. No surprises there.

Your first shock comes when you run the program. In place of the usual opening menu is . . . well, not much. You still get the disk directory, but instead of the full menu is a menu bar. Pressing the first letter of one of the options brings down another menu. The drop-down windows are available in edit mode, too, where the first letter of the option is used with the Alt key to call up the menu.

The new menus may help to sell the package to people who are new to the program. WordStar's problem has always been that it is hostile to new users. The largely illogical control keystrokes can be difficult to learn, and the old style of menus — now called 'classic menus' — was always a compromise. Now you can find most of the program's features quite easily. However, all the old keystrokes still work, so existing users will have no problems. The drop-down menus can be turned off — they are selected by setting the help level to four. Old hands can set the help level they normally use and WordStar 5 will look and behave just like version 4.

Other areas have also been tidied up. Dialogue boxes are used in place of simple prompts. For example, instead of getting a prompt to type in the new value when you set a new margin, you get a form covering the full range of formatting values — margins, page size and so on. Dimensions can be entered in inches,

The first thing that strikes you as different is WordStar 5's new-look opening screen with pull-down menus

Within the text it is now possible to embed commands to change fonts and line spacing, and even to include footnotes

as well as the more conventional columns and lines, and this is an important step. Doing everything by columns was fine in the days when the vast majority of printers had simple, mono-spaced fonts. Now that there are such things as laser printers and dot-matrix printers with sophisticated proportional printing capabilities, it's about time WordStar was able to use them properly.

WordStar 4 had minimal laser printer support. Selecting a font was a matter of inserting a character width dot command on the previous line, which meant that fonts could not be mixed on the same line. WordStar 5 has sorted that out, and by far the most impressive feature of the new program is the way the software understands printer fonts.

To give you an idea, let's take an example of something that can drive word processor users nuts. Imagine you are using a dot-matrix printer and want to have three paragraphs on the page, with all the lines having the same physical width but with one printed at 10 characters to the inch, one at 12 and the other at 17 (condensed). Normally, you would have to work out how many characters you would get to the line for each typestyle and set three rulers accordingly. This is pretty hit-and-miss and would probably require printing several drafts until you got it right.

But not with WordStar 5. It has a database of all the most common, and many uncommon, printers. It knows how wide each character is, so you look at your page, decide how wide you want the text, and set just one ruler. When you change character styles, the program knows what you're doing and adjusts the number of characters you can type into each line.

Proportional fonts

And it gets even better. Not only can software handle mono-spaced type in this way, but it will also take care of proportional fonts, fully justifying them if desired, with microspacing. The result is extremely neat text with the minimum of effort. You can also have tabular matter with proportional fonts — something which was impossible with earlier versions. Decent desktop publishing software does this already, of course, but is generally over the top for simple word processing requirements.

Selecting a font can still be done with a dot command, but now you can call up a menu of all the printer's available fonts, position the cursor on the one you want, hit Return and an embedded printer command is put into the text. That means you can mix fonts on the same line. The embedded command shows up on the screen as the font name in angle brackets — for example, <COURIER 12>. Along with other format commands for underline, bold and so on, this can be turned off at any time, giving a less cluttered screen. The default setting for code display — on or off — can now be set with WSCHANGE.

The program's printer database is pretty comprehensive, and MicroPro has promised to update it regularly. If your printer isn't there, however, WordStar 5 has a printer definition utility program to create your own drivers. Messing with printer codes isn't for the faint-hearted, but it's a useful thing to have.

(Incidentally, when I installed the driver for the Epson LQ-800 and tried to select sheet-feeder operation, the program told me that this printer doesn't have a sheet-feeder. Obviously, no-one has told

Epson, and I was found jumping up and down, pointing at the sheet-feeder and yelling "What's this, then?" It had no effect.)

Editing

The edit screen is as reasonably uncluttered as ever. The status line along the top now has the horizontal cursor position in inches as well as columns. If drop-down menus have been selected, the menu bar is on the second line, with the ruler below that. The familiar on-screen prompts for normal and shifted function keys at the bottom of the screen are switched off when you have menus, but return when you select a lower help level. You can turn them off altogether.

Another genuine improvement is automatic reformatting of text. WordStar users are accustomed to frequently hitting Ctrl-B to reform a paragraph after editing. Now the program does it for you, although it waits for a brief period of inactivity or until you've moved to another line before doing it. The result looks a little jerky, and it doesn't always happen — inserting a block of text into a paragraph is not inevitably followed by automatic reforming — but it's better than the old system. If you don't like it, you can turn the feature off with WSCHANGE.

The edit screen shows which words you'll get on which lines, but there is no real attempt at a WYSIWYG display. For that you have to switch to the page preview option, which appears to be a development of the system used in PageSetter, MicroPro's add-on DTP package for WordStar 4. There's a pause the first time you run it, while it builds display fonts, but after that it's pretty snappy. A single page can be dis-

Page Preview mode allows you to 'print' the text and font information to the screen before committing yourself to paper

Two documents can be held in memory and the screen can be split in two to display them both at the same time

played, parts of it magnified, or you can opt for a series of pages — altogether on the screen or displayed one at a time. It worked well on my NEC PowerMate, which has an EGA monitor. It should look reasonable on Hercules screens and good on VGA, though I'd hesitate before recommending it to CGA users. At the very least, it should save you some paper and printing time by displaying problems before you get to hard copy.

On one occasion the page preview revealed that WordStar was not printing the page numbers I had asked for in the headers. As usual, I'd put a hash character at the point where I wanted the numbers to be printed. WordStar normally assumes you want to start at page one and everything sort of follows on from there. But not now. WordStar 5 wouldn't do anything until I'd put in a dot command explicitly saying I wanted to start with page one (.pn1). If you have lots of standard files using page numbers in headers or footers, you will have to go through them all adding this dot command — a small but irritating lack of compatibility.

The page preview is most useful when you're using snaking columns. These are fairly easy to set up, but may require some fiddling to get exactly right. A dot command is followed by the number of columns you want on the page and the size of the gap between them. Only one column is shown at a time, but you know which one it is from a symbol at the left edge of the screen. Hard and conditional column breaks are available.

If you want something like a three-column piece of text in the middle of single-column copy, you have to set the rulers for each bit yourself. However,

WordStar 5 allows you to define up to 10 standard rulers, which makes life easier for people producing things like newsletters to standard formats.

Word count

I'm often heard bemoaning the lack of a word count in WordStar. In my business I write to a specified length and I'm paid by the word. In previous versions of WordStar, to find out how much I'd written I had to run a separate DOS program — remembering to save the file first. In WordStar 5, hitting Ctrl-K? gives a word and character count for the file.

> 'Most of the
> enhancements are
> genuine improvements . . .
> Even the user interface
> looks like something from
> this decade, but I can still
> hear Macintosh users
> laughing their socks off.'

But now I'm going to start moaning again — after the count, the cursor is left at the end of the file. You must hit Ctrl-QP to return to your original position, and there seems to be no way of combining the command in a keyboard macro or function key. The exception is when there is a highlighted block. In this case, only the words in the block are counted and the cursor stays where it is.

I ran the word counter alongside WC.EXE, the program supplied with

WordStar 4. They generally agreed on small, simple files, except that WC.EXE was consistently higher by 62 characters. That's because it's counting the formatting information at the start of the file.

There are two major problems with the new word count — it doesn't count numbers as words, and it doesn't count footnotes or endnotes — so if you're paid by the word, keep those notes short! It also counts hyphenated phrases as single words, so that 'state-of-the-art machine' counts as two words — personally I'd rather be paid for five.
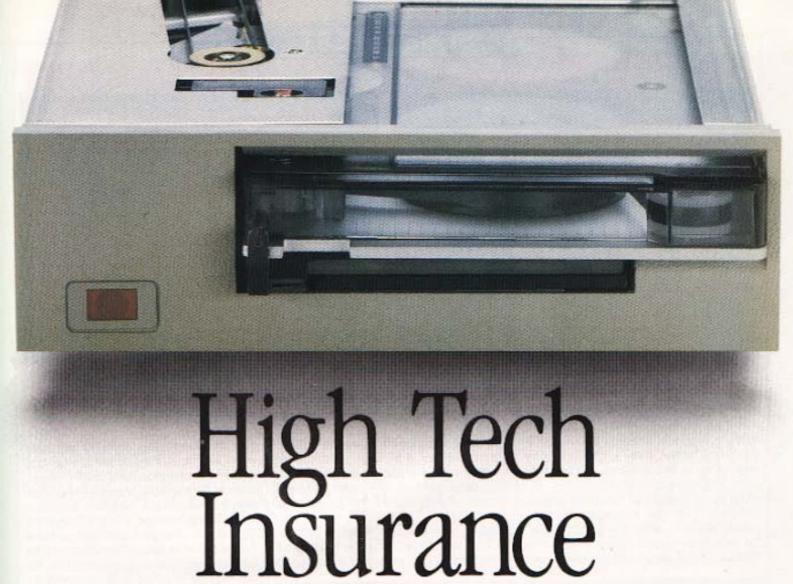
Technical writers will appreciate the addition of footnotes, endnotes and comments. Several styles are available for marking notes — numerical, alphabetical and asterisks — and you can choose to have the sequence start again on each new page or carry on. You can also select your own markers.

Footnotes are printed at the bottom of the page, endnotes at the end of the document, and comments are non-printing notes. Once you've selected the type of note you want, a second window opens up for you to type it. This window can be called up any time the cursor is on the note marker. If the program is set up to display control codes, the note marker (which is otherwise highlighted) is replaced by the first few words of the note between square brackets.

I'm disappointed that you can't move blocks of text from the notes into the main text. It would be useful to keep rough notes as a non-printing comment, and then move them into the main text when desired.

The second window has other uses apart from the notes. You can open the window to look at another file or another part of the same file. This time you can

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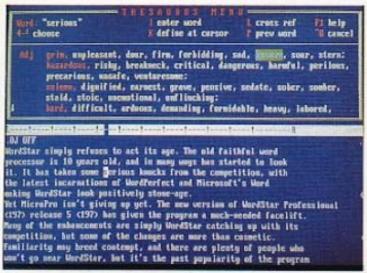
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The spelling checker is far more interactive than before, providing a list of possible words to replace the word it hasn't recognised

When you want to edit a footnote, a second window is opened. The actual position of the footnote is noted by a 1 in the text

move or copy text between the windows. It's a split-screen utility rather than real windowing — two windows is the maximum, which is a little miserly.

The spelling checker has been slightly enhanced. It now manages to spot double words — when you type 'the the', for example — and query them. The thesaurus has also been improved and

is better integrated into the word processor, being built-in rather than using WordFinder as a pop-up program. It offers definitions of the most common words, like a dictionary, as well as synonyms.

Some of the other minor points include: WordStar 5 uses hard tabs rather than just inserting spaces, so

that tabulated text reforms properly when you move the tab stops; selecting formatting options using control keys, such as hitting Ctrl-OJ for right justification, results in the relevant dot command being inserted into the document so that the change is permanent; there is now a cursor position indicator on the current ruler; there are commands for converting marked text to lower or upper case; odd and even pages can be given different headers, footers and page offsets; automatic paragraph numbering is available; and the current file can be saved under a new name, making the production of multiple documents much easier.

In many ways, WordStar Professional is starting to look a lot like WordStar 2000. Many of the features found in 2000 release 3 have turned up here. These include the famous shareware outliner, PC-Outline, which is now bundled with the package. But it's somewhat tacked on, as you have to shell out to DOS to run it, and the only concession to integration is a new option in PC-Outline to import WS5 files (it also handles WS4 files).

Another feature copied from WordStar 2000 is SpeedWrite. Rather than go through the process of naming a document and confirming that name, you can go straight into edit mode — naming and saving the document later.

Other add-ons include an adequate mailmerge program and a neat file locator, ProFinder, which will scan directories, searching files for a combination of up to three strings. Files can be previewed, and there are some disk organisation utilities. And there's the Telmerge communications package for

Upgrading from earlier versions*

If, like me, you are an inveterate WordStar user and are fearful that MicroPro may have ruined your beloved program . . . stop worrying. You can use WS5 in the same way you used the older versions. The drop-down menus can be ditched, the automatic reformatting turned off and all the old commands used as normal. The only real problem you are likely to have is in moving files between versions.

WordStar 5 appears to load files created by earlier versions without any problems. At one point it seemed to automatically convert a page length entered in lines to inches. But going the other way is a problem, as MicroPro has seen fit to mess around with the file structure.

Try loading WordStar 5 files into an earlier version of WordStar and you will see all kinds of garbage at the beginning, including the name of the installed printer. This is formatting information, and earlier versions have no idea what to do with it. MicroPro has provided a driver so that files can be printed to disk in WordStar 4 format, but it's a pain to have to do it and the resulting file may still need some work before it's usable.

If you are a newcomer to WordStar, or upgrading with no intention of looking back, this is unlikely to worry you. But in a business environment, where several versions of the program are used on separate machines, having to convert a file before using it on another micro is extremely tedious.

The embedded printer information also needs to be watched. If you create a file on one machine installed, for example, on an Epson dot-matrix printer and try to print it on another machine installed for a different printer — a laser, perhaps — WordStar will take one look at the file information and decide it's printing to the Epson. Fortunately, it's simple to select the correct driver at print time and, if you want to change the default printer for that file, you can do it during edit mode.

An attractive feature of WordStar's printer support is that the program goes through your text looking for embedded font commands when you change the default printer. It then attempts to replace all the old fonts with the closest possible match from those available on the new printer.

SCREENTEST

sending documents across E-mail systems or between directly linked PCs.

Some of the extra features demand more memory. A minimum of 384k is required, and you'd better have 512k if you want to use things like page preview and PC-Outline.

Bugs

There appears to be a few bugs left in the program. For example, when I selected Roman Proportional from the font menu for an Epson LQ-800, what I actually got was Roman Proportional Condensed. I cured it by selecting Roman 12 and sticking the dot command for proportional spacing on the previous line, but it was somewhat inelegant. When I complained to MicroPro, the company gave me a fix which involved renaming the font using the printer definition utility program!

While I was using a Tandon AT, the program hung every time I tried to use a keyboard — after it had carried out the macro commands — although I had no such problems with the NEC Power-Mate. I also had a few odd things happen when words wrapped while the cursor was on the bottom line, with the screen failing to scroll. There was no text corruption, however, and the problem disappeared once I'd paged one way and then back again.

Prices

The single-user price of WordStar 5 is $700. Upgrades from earlier versions of WordStar Professional, WordStar 2000 and NewWord 3 are available for $250.

Conclusion

Although the excellent printer support and multi-column mode show MicroPro borrowing from the desktop publishing world, there has been no real attempt to turn WordStar 5 into a quasi-DTP package. For one thing, graphics support is negligible. MicroPro is still aiming at its traditional market — heavy-duty, text-only word processing.

Overall, MicroPro has done a good job of dragging WordStar into the late 1980s, and this release should keep it among the front runners in the word processing field. Most of the enhancements are genuine improvements, many of them imaginative and worthwhile rather than gimmicks or bug fixes. Even the user interface looks like something from this decade, but I can still hear Macintosh users laughing their socks off.

END

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Face to face with Open Look

Can a new graphical interface give Unix the edge it needs to challenge OS/2 as the dominant PC operating system of the '90s? Tony Hoeber reports.

For years now, the Unix operating system has been like an athlete with potential — it has great talent but somehow has never lived up to expectations on the playing field.

While Unix is one of the most capable and powerful operating systems available, it still has a very small installed base (about 350,000 licences and some one million users) compared to the MS-DOS operating system (more than 10 million users) or even the Macintosh Finder (close to two million). Many industry observers would agree that the main problem with Unix has been its lack of an accessible, easy-to-use interface.

In April 1988, AT&T announced a new graphical user interface called Open Look, destined to be the user interface for Unix System V version 4.0, the converged version of the three most popular variants of Unix: System V, Berkeley (BSD) 4.2 and Xenix. Designed for AT&T by Sun Microsystems and based on technology licensed from Xerox, Open Look was designed to be independent of the hardware and software on which it runs; as such, it can be used with operating systems other than Unix.

The graphical interface story

The development of graphical user interfaces can be traced to commercial products such as the Xerox Star, Smalltalk and the Macintosh; to academic projects such as the Andrew system from Carnegie-Mellon; to research systems such as Diamond and Sapphire; and to many applications in areas like CAD and desktop publishing.

The roots of all these systems go back to work done at Xerox's Palo Alto Research Centre (PARC) in the 1970s. Among the more influential of the Xerox systems are Smalltalk, the Star (and its successor ViewPoint), the Bravo Editor

and the Cedar development environment. These systems introduced many of the ideas that have come to be taken for granted as the basic elements of graphical user interfaces: windows, icons, menus, the desktop metaphor and direct manipulation of objects on the screen by the user. The designers of the Star, in particular, placed great emphasis on the consistency of the user interface.

In the early 1980s, the designers of the Apple Macintosh took those ideas and combined them in a design tuned for a specific machine, market and price point. The Macintosh had a single-process operating system and a small screen. This led to a user interface based on a single top-of-the-screen menu bar used by whatever program was currently active. The designers envisioned an interface that was simple and accessible to non-technical people. This emphasis on simplicity also led to the choice of a single-button mouse.

The Open Look user interface for Unix builds on and enhances both of these traditions — the consistency of the Star and the simplicity of the Macintosh. Beyond specific features, however, the major significance of Open Look is that it is not tied to a particular computer or operating system.

The 'Open' in Open Look

The Xerox Star was a tightly integrated, closed system. The hardware, operating

system, windowing system, user interface and applications were all built by the same company, so consistency was ensured.

Similarly, the Macintosh was a closed system, though Apple broke the applications out of the bundle. As independent software developers began to supply applications for the Macintosh, consistency across applications emerged as a crucial issue. Apple addressed this issue by publishing user-interface guidelines and creating a culture that encouraged application developers to follow the conventions.

With the advent of open systems like the Mac II, hardware as well as software is now available from companies other than Apple. Meanwhile, a variety of graphics-oriented system software (eg. Windows and the Presentation Manager) is now available for 8086/80286/80386 machines.

In graphics-based systems, the trend from tightly integrated, single-vendor systems towards loosely integrated, multi-vendor systems has important consequences for user interfaces. The designers of the Star took the position that the hardware should be designed specifically to fit the software. The designers of the Macintosh also designed their look and feel with reference to a particular operating system, display and mouse.

Open Look takes this evolution to the next step. It was designed from the start to accommodate different keyboards, mice and screen resolutions. The interface is not tied to a particular piece of hardware, operating system or windowing system, so it is possible for applications to have a consistent look and feel, regardless of what hardware or operating system they happen to be running on.

First look at Open Look

In Open Look, the display screen is called the 'workspace', which contains windows and icons representing application programs. An application typically consists of one main window (in which the application's data is displayed) and several pop-up windows that you use to manipulate the data.

Fig 1 shows a typical Open Look screen with sample applications called Draw and Write. Notice the L-shaped corners on the applications' windows, suggesting picture mounts from a photo album. By clicking and dragging these mounts, you can resize a window from any corner.

At the top of each application window is the 'header', which contains the name of the application and a window mark that closes the application when you

click it. Below the header is the application's 'control area' which provides access to the application's main functions, such as opening and closing files. The control area typically consists of a single row of buttons. You 'push' these buttons by moving the mouse pointer over them and clicking the Select mouse button. (For an explanation of Open Look's approach to mice, see the box 'Open season for mice'.)

As you can see in Fig 1, there are two styles of buttons: those with a single, heavy shadow are simple buttons, representing a single command. Those with a double shadow are 'button stacks', representing several related commands.

To perform the default action on a button stack, you click the Select mouse button. Pressing the Menu mouse button calls up the menu associated with the stack. The Edit button's menu in Fig 1 has been opened up in this way. Notice

Fig 1 A typical Open Look screen with edit and draw applications. Each application consists of one main menu (which you can resize using the L-shaped corners) and several pop-up windows that you use to manipulate the data

> 'In multi-tasking systems the hourglass is only visible when the pointer is over the window that is busy. This requires you to keep the pointer in the busy window so you can see when it becomes responsive again . . .'

that the menu itself contains buttons and button stacks. By using the two types of buttons in combination, an application can support far more commands than it could display on the control panel.

Below the control area is the 'pane', in which the application displays its data. The form that data takes is up to the application; usually it is text, a drawing or a spreadsheet.

To the right of the pane is a scroll bar that lets you move the contents of a document within the pane. As you can see in Fig 1, the Open Look scroll bar resembles an elevator riding on a cable that is

anchored at either end. Clicking on the top arrow moves you one line towards the top of the document; clicking on the bottom arrow moves you one line towards the bottom. Because the arrow buttons are located next to each other on the elevator instead of at either end of the scroll bar, you need only move the mouse a short distance to reverse directions.

To jump directly to the beginning or end of the file, click on the top or bottom cable anchors, respectively. Finally, you can move to any part of the document by pressing in the middle of the elevator and dragging.

Property windows

Open Look's debt to the Xerox Star is evident in its use of 'property windows' that let you view and modify the properties of any object you can see on the screen.

To change an object's properties, you first select the object of interest. Then choose Properties from the appropriate menu (which will change depending on the application and the object you select). This will bring up a window with controls that you can use to modify the properties of the object. All property windows work in exactly the same way, regardless of which object you are changing. For example, you could select a word in a word processing program and change its font; select the main window of an application and change the application's background colour; or select the screen background and change a global property such as the volume of the system bell. Fig 2 shows a typical property window for a word processing application.

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Bangs per buck

Bangs per buck — just one way of comparing the relative merits of these seven ultra cheap clones. The lighter shading denotes price (in thousands of dollars) and the darker shading a performance index. See Table 2 for more details. (Machines from left to right are... Amstrad, West Jung, MicroDOS, Commodore, Uni-x, Nomad and Techno

Processor.
NEC. The Uni-x contains a NEC V20 manufactured by Sony.

Thus a V20 running at 4.77MHz will outrun an 8088 running at the same clock speed... machines examined provided a standard PC clock rate of 4.77MHz as a minimum, although the Uni-x delivered higher than standard performance even on this clock rate by virtue of the V20. The Atlantis and machines.

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The first two lines in the property window of Fig 2 are examples of settings that let you choose from predefined choices. When you select a setting, its border becomes outlined in bold. Settings whose borders touch are exclusive — only one choice may be on at a given time. Settings whose borders do not touch are nonexclusive — you can toggle each choice on and off independently of the others. Below the settings is a text-entry field and below that is a sliding control that lets you choose quickly from a range of values.

All property windows have a special control, known as the 'pushpin', at the right of the window header. When the pin is on its side, as in Fig 2, the window will disappear when you click the OK button. If you click on a pushpin, it pops into the hole next to it. The window will remain until you dismiss it by clicking on the window mark in the header. Using the pushpin lets you perform multiple operations (such as changing font characteristics of various words throughout a document)

Text Properties (OK)

Font: [Serif] Sans Serif | Typewriter

Style: [Bold] [Italic] Underline

Catalog Name: Bold italic

Color: White ■■■■■□═══ Black

Fig 2 A typical Open Look property window for a word processing application. Settings whose boxes are closed together are exclusive — you can only choose one at a time. With settings whose boxes are separated, you can choose as many as you want

without having the window disappear after each action.

An application may also have pushpins on menus, thus allowing the menu to be pinned up for repeated use. Fig 1 shows examples of both pinned and unpinned menus.

Additional pop-ups

A special type of pop-up window is the 'notice', which asks you to confirm operations that would result in the loss of data. Notices appear to project from the button that prompted their appearance.

Fig 3 Open Look's three-dimensional notice windows alert you to actions that could result in loss of data

as shown in Fig 3. This 'projection' acts as a visual prompt.

Open Look provides help through a standard help window (see Fig 4) that appears when you point at an object on the screen and press the Help key on your keyboard (which will vary from system to system).

Next to the help message is the 'help lens', a magnifying glass that contains a snapshot of the object for which you have requested help. As you move the mouse pointer from object to object and press the Help key, both the image in the lens and the help text are updated.

Design goals

The main goals of the Open Look design were to provide the following: good visual design; a balance of simplicity, consistency and efficiency; device independence; and interoperability with other widely used interfaces.

One of the most challenging aspects of visual design is the use of colour. The problem is to use colour so it emphasises useful distinctions and adds interest to the visual scene without producing a neon 'Las Vegas' effect.

Some user interfaces show each visual element — buttons, scroll bars, window headers and so on — in a different colour, resulting in a random clutter of bright colours. In contrast, Open Look allows you to choose the colours for three areas of the user interface: the background of the screen, the background of each window and the currently selected object. This use of colour serves several purposes. The backgrounds of the windows are coloured with neutral tones so that they will not overwhelm whatever information the application is displaying. Also, since a single background colour is used for all the windows of a given application, you

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┌──────────────────────────────────────────────┐
│ ▦        Paint: Load / Save          .─▯      │
│  Paint type: │Picture│ Region                 │
│  File type:  │Raster│ Icon                    │
│  Directory:  /home/ol_images2                 │
├─────────────────────────────────┐            │
│ ▦       Help: Pushpin            │            │
│    ┌──────────────────────────────────────┐  │
│    │ Use the pushpin to keep a pop-up window│ │
│    │ pinned to the desktop for continued access.│
│    │ Move the pointer to an unpinned pushpin and│
│    │ click SELECT to push the pin into the hole.│
│    │ Click SELECT on a pushpin that is pinned to│
│    │ pop it out of the hole.  When the pin is lying│
│    │ on its side, the pop-up window is removed│
│    │ from the screen the next time you click│
│    │ SELECT on a control in that window.  │  │
│    └──────────────────────────────────────┘  │
└──────────────────────────────────────────────┘
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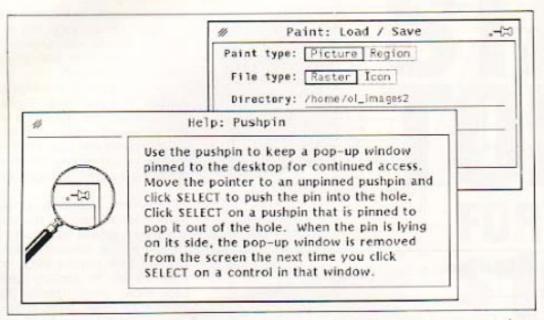
Fig 4 The Open Look help window, called by pointing to an object on the screen and pressing a Help key, contains a help message and a help lens, with a snapshot of the object for which you have requested help

Several aspects of the Open Look design reflect this emphasis on consistency. Throughout the system and across applications, a given mouse button is used for only one function. We aimed for visual consistency in the design of controls: buttons and settings look the same, regardless of whether they appear in a pop-up menu or in a window. The help window is another example of consistency: you can point to any object on the screen and get help, regardless of whether it is a standard element of the system (such as the pushpin) or an application-specific object such as a particular button.

Open Look has taken many other well-established conventions of graphical user interfaces and applied them in a more consistent way. For example, in Open Look, we extended the familiar selection paradigm to include the screen background, so you can select multiple windows and move or close them in a single operation. Another example: while earlier interfaces let you manipulate graphics objects directly, Open Look lets you select and drag arbitrary pieces of text as well (see Fig 5).

Efficiency is easier to measure than simplicity or consistency. The fewer moves needed to perform a task, the more efficient the interface. This means minimising keystrokes, mouse travel and the need to switch back and forth between the keyboard and the mouse.

Minimising mouse travel becomes more

can tell at a glance which pop-up window goes with which application.

Against the neutral background, the eye is naturally drawn to the brightly coloured selection (eg, the block of yellow text in Fig 1), which is the focus of the user's attention.

Open Look provides several palettes from which you can choose the colours of the screen background, window backgrounds and the current selection. The colours in each palette have been chosen by the graphic designer so that they go well together. This approach accommodates individual tastes while ensuring that the overall effect will be

pleasing and the text will still be readable.

Simplicity, consistency and efficiency are the basic principles that guided the Open Look design. When you're doing a new task, you want the interface to be simple. If the interface is similar to that of a task with which you are already familiar, learning will be easier. And when you are doing a task over and over, you want the interface to be as efficient as possible.

It is hard to over-emphasise the importance of consistency. Consistency lets you learn many applications and switch easily among them.

Fig 5 While earlier graphical interfaces pioneered the direct manipulation of graphics objects, Open Look extends this, allowing you to select and drag arbitrary pieces of text as well

important as more systems use large screens. One way to reduce mouse motion is by using pop-up menus. In Open Look, each region of the screen — the workspace, the window background, scroll bars and each application pane — has its own pop-up menu with relevant buttons. Instead of having to move all the way to the control area, you simply press the Menu mouse button, which effectively brings a control area to wherever the pointer happens to be.

Another way that Open Look minimises mouse travel is by jumping the mouse pointer to a default button when a pop-up window (such as a notice) appears. If you click on the default button in the window, the pointer jumps back to its original position — saving two mouse motions.

A more subtle aspect of efficiency is allowing users to take advantage of the multi-tasking capability of an operating system like Unix. Take the problem of how to indicate that a window is busy and will not respond to input. Most systems change the mouse pointer into an hourglass or timer. In a single-tasking system such as the Macintosh, this is appropriate, since you can't do anything else until the active window is finished.

In multi-tasking systems, however, the hourglass is only visible when the pointer is over the window that is busy. This approach requires you to keep the pointer in the busy window so you can see when it becomes responsive again. In contrast, when an Open Look window is busy, the window header (or icon, if the window is closed) turns grey. Thus, you can move the pointer out of the window and work on something else, and still tell at a glance when the window is again responsive.

Device independence

Open Look was designed specifically to be used across a wide range of hardware. This requirement means that the visuals must work well on displays of various resolutions and sizes and on both monochrome and colour. It also means that all the details of the look — each graphical element and the amount of white space between elements — must be specified in device-independent terms rather than as bit maps.

Hardware differences on the input side are also significant. The number of modifier keys (eg, Alt, Option and Control) varies on different keyboards, as does the number of buttons on different mice. As far as possible, Open Look insulates you from such variations by allowing a great deal of flexibility in mapping mouse buttons and modifier keys to functions.

Changing horses

Design is never done in a vacuum. The user of a new interface will always approach it with a background of experience with existing interfaces. This means that every change comes at the price of increased learning effort on the part of the user.

The Open Look design team envisioned a typical user who wants to

Open season for mice

Open Look was designed to work with a one, two or three-button mouse. The interface provides for three mouse functions called Select, Adjust and Menu. Select lets you select and drag objects and manipulate controls such as buttons. Adjust lets you adjust a selection (such as selecting more text). Menu lets you display and choose among pop-up menus.

On a one-button mouse, the unmodified button is Select, with modifier keys (such as Alt or Option) required for the Adjust and Menu functions. On a two-button mouse, you use the left button for Select, the right button for Menu, and the Select button plus the keyboard Shift key for Adjust. On a three-button mouse, the default assignments of the buttons are, from left to right, Select, Adjust and Menu. Again, these are the default assignments; regardless of the type of mouse, you can change them if you want. For example, on a two-button mouse, you could assign Adjust to the unmodified right mouse button and require a modifier key for Menu.

switch easily between Open Look, the Mac Finder and the Presentation Manager. We therefore ruled out design possibilities that would make this switch too difficult.

Take the example of scroll bars. There are endless variations on the scroll bar concept, and many other possible ways to scroll that don't even involve scroll bars. After considering many of these possibilities, we became convinced that Open Look's scrolling mechanism had to be similar enough to what people were used to so they could use it successfully right away. The design task, then, was to refine the familiar scroll bars, making them more visually attractive and more efficient.

An Open Look at the future

The Open Look Functional Specification — a thick book addressed to the developers of user-interface toolkits and describing the look and feel in great detail — was distributed to over 1000 firms in the US for review in July 1988 and will be published in December. (A toolkit is a set of system-specific libraries containing the standard building blocks — such as windows, menus and scroll bars — that an application developer uses in creating an application. Fig 6 shows where a toolkit fits into the overall software architecture.)

The Open Look Application Style Guide, a somewhat thinner book addressed to application developers, gives guidelines on how to use the various building blocks that Open Look provides. The Style Guide will be published in early 1989.

Since the Functional Specification does not specify a particular hardware or software platform, it leaves room for different toolkits to implement the Open Look user interface on different systems.

| Application |
| Open Look user-interface toolkit |
| Window system |
| Operating system |
| Hardware |

Fig 6 Toolkits for the Open Look user interface will allow software developers to develop applications for a variety of windowing systems running on widely disparate hardware and operating systems. The first toolkits available will be for Unix systems

The first two Open Look toolkits — available in the first quarter of 1989 — will be XT+ from AT&T and View2 from Sun, both based on MIT's X-Windows, a windowing system for Unix.

Sun is also developing an Open Look toolkit called NDE (for NeWS Development Environment) based on the NeWS window system. NeWS is a portable, PostScript-based window system that is commercially available for many platforms, including Unix, OS/2 and the Macintosh. Thus, when NDE becomes available in the second quarter of 1989, Open Look will be able to provide a common look and feel across a wide variety of computers and operating systems.

END

Tony Hoeber is the leader of the Open Look design team for Sun Microsystems.

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The inside story

Peter Jackson assesses the implications of the new video graphics array standard introduced by IBM on the PS/2 range, and Andy Redfern presents the results of compatibility tests run on a variety of VGA boards.

Whenever IBM has decided what the new graphics standard is to be for the PC industry, it has never taken long for the chip-set and board manufacturers to produce new hardware to mimic it. The Monochrome Display Adaptor (MDA) and Colour Graphics Adaptor (CGA) of the original PC and XT were easy, since they used off-the-shelf chips throughout, and the later Enhanced Graphics Adaptor (EGA) standard did not go much beyond CGA and caused the cloners few problems with the three main custom circuits.

But the Multi-Colour Graphics Array (MCGA) and Video Graphics Array (VGA) standards introduced with the PS/2 line 18 months ago were a different matter. IBM had built the graphics circuitry and its associated video BIOS routines into the PS/2 motherboards, using its own custom gate array chips, and had posted dire warnings all over the machines concerning patent law and technological copyright. And the designs were a departure from what had gone before, with higher levels of integration, new extended video modes, and analogue output to support up to 256 simultaneous colours from a choice of 262,144.

Given this, the relatively rapid emergence of VGA clone boards was something of a surprise; rather less surprising was the fact that these boards did not work particularly well. What the early entrants had realised was that in software terms the VGA standard was a superset of the EGA, and that their EGA-compatible chip sets already include support for many of the VGA-specific display modes, such as 640 by 480 in 16

colours, when driven at the higher frequencies. All that was needed was the addition of an Inmos digital-to-analogue converter (DAC) chip as used in the PS/2s to help drive analogue monitors, some extra logic and some rejigging of the video ROM BIOS so that software aimed at the VGA would have its commands adapted to suit the enhanced available EGA hardware.

It was at this point that discussions of BIOS-level and register-level VGA compatibility began to arise. The first VGA boards could certainly accept commands from VGA software, but only as long as they were routed tidily through the MS-DOS Int 10H interface and the customised BIOS routines on the boards themselves. The underlying hardware was certainly not the same as the VGA chip in the PS/2, and software attempting to bypass the video BIOS and write directly to the VGA hardware for extra speed or for other reasons would fail to work in a variety of interesting fashions. On top of that, the rewriting of the BIOS to support VGA was up to the board makers, resulting in BIOS code of varying quality with corresponding variations in performance.

Since programmers have always used the hardware available to their own advantage, there was no guarantee that future VGA software would work on the BIOS-level-compatible boards. Future compatibility required deeper hardware compatibility with the physical circuitry of the IBM VGA chip, particularly the set of registers and register locations used to control all the graphics display features. Also, register-level compatibility was promised by a group of custom chip

designers and board manufacturers including Paradise Systems, Tseng Laboratories, Chips and Technologies, Video Seven, STB, AST and Genoa.

The first boards claiming this compatibility level finally started to appear about a year after the initial PS/2 launch, after intensive dismantling and reverse-engineering of the VGA chip in an attempt to duplicate its functions without duplicating its patented electronic design.

However, the first VGA-compatible custom chips also suffered from compatibility problems. Video Seven's first Vega VGA board, for example, using its own VGA chip, did not run properly with various packages including Microsoft Windows, despite its claimed register-level cloning of the IBM chip.

To see why register-level compatibility is important and why it turned out to be such a tough thing to implement, it is necessary to understand the physical structure of the VGA chip, the way it controls what we see on VGA-compatible analogue or multi-scan monitors, and how application software interacts with the hardware to make the new graphics modes useful. Then it will be easy to see why boards that claim register-level compatibility can still fail tests that work on IBM's official VGA, and why a third form of VGA compatibility — full hardware compatibility — will be required if customers are to feel fully secure with all future software releases.

Video hardware

Any display on a computer monitor is produced by a complex mixture of

1 15-pin analogue connector
2 PC bracket
3 Inmos G1765 DAC palette chip
4 VGA feature connector
5 BIOS ROM (384Kbit total)
6 44-pin piggyback connector
7 Video 7 LIA4199 VGA chip
8 V-RAM expansion sockets
9 256K V-RAM
10 44-pin piggyback connector
11 DIP switch
12 Crystal oscillators
     ● 65MHz ● 40MHz
     ● 28.332MHz ● 50.3350MHz
13 16-bit extensions for AT bus
14 8-bit edge connector

electronics, electromagnetics and subtle timing. A single electron beam (for monochrome) or a set of three electron beams (for colour) is scanned across the phosphor-coated screen surface using electrostatics to drive the beam and an intricate set of electromagnetic coil windings to do the scanning. Then the video hardware inside the computer generates signals that modulate the intensity and 'colour' of the electron beam as it scans, and also supplies timing information to synchronise the scanning process with what is going on inside the video hardware.

The video signals are produced by a video signal generator that forms part of the video board's circuitry. The main purpose of the generator is to repeatedly read the contents of the board's video RAM area and translate this information into the type of signal that can modulate the electron beams in the monitor. The video signal generator scans video RAM many times per second, ranging from 50 times to 70, or more depending on the display system being used, so that any changes in the RAM area — a character typed by a user in a word processing program, for example — will be reflected on the screen almost instantaneously.

The video RAM area, usually 256k for EGA and VGA types, fits into the PC's memory map and can be written to and read from — by our word processing program, for example — just like any other lump of RAM. In simple monochrome bit-mapped graphics mode, like the Hercules display standard, each bit in the video RAM area relates directly to a pixel on the monitor; change a bit in video RAM from '1' to '0', for example, and a dot on the screen disappears. However, things get more complex when both text and graphics modes need to be supported, and extra decoding hardware is necessary between the video RAM and the video signal generator.

For example, in monochrome text modes the data in the video RAM must be treated as a set of ASCII codes rather than a block of bits, and character generator hardware is used to translate those codes into dot patterns that can be written line by line to the screen by the video signal generator. Similarly, special text like bold or underline is handled by adding extra bits to the ASCII code in the video RAM. An attribute decoder must also be included to read these bits and add the appropriate attributes to the dot patterns produced by the character generator before they go to the video signal generator.

In colour graphics modes a section of video RAM corresponds directly to a single pixel on the monitor, but the size of that section depends on the mode. If each pixel can be displayed in any one of 256 colours, as in the 320 by 200 256-colour modes of MCGA and VGA, for instance, then each bit on the screen is represented by a full byte in video RAM. If only four colours are to be allowed, then just two bits in video RAM represent each pixel displayed.

The attribute decoder that handles special text features also decodes colour information from the video RAM area, having been 'told' what graphics mode the system is in and therefore 'knowing' the format that display information will be in when it is read from video RAM.

While the screen resolution depends fundamentally on the frequency at which the video hardware can write pixels and the horizontal and vertical scanning frequencies of the monitor, the amount of video RAM available can also have an effect. A 640 by 480 two-colour display occupies just 37.5k of RAM, but adding extra colours adds to the memory requirements. With the same 640 by 480 resolution and four available colours, 75k of video RAM is required, while a 16-colour display requires 150k and dis-

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VGA test results

Board	Chip set	Test machine	BIOS ROM
AST VGA	Paradise PVGA1/Custom	AST Premium 286/386	256k, 150ns
Video Seven V-RAM VGA	Video Seven L1A4199/Inmos G176S	AST Premium 286/386	384k, 200ns
Designer VGA	Tseng Labs 11051AG/Inmos G171S	AST Premium 286/386	256k, 200ns
VGA Plus	Paradise PVGA1A/Inmos G171S	AST Premium 286/386	256k, 200ns
Phillips VGA	Video Seven 420/Inmos G176S	Inter Orient 386	256k, 250ns
On-Board	Compaq/Inmos G176S	Compaq Laptop	On system
On-Board	Paradise PVGA1/Inmos	Amstrad 2386	256k, 150ns
Wyse VGA	Tseng Labs 11051AG/Inmos G171S	Inter Orient AT	256k, 200ns
Fastwrite VGA	Video Seven L1A4199/Inmos G176S	Dell 310	384k, 200ns
Vega VGA	Video Seven 829/Inmos G176P	Dell 310	256k, 200ns
On-Board	Compaq/Inmos G176S	Compaq 386/20e	On system
VGA Professional	Paradise PVGA1A/Inmos G176P	Dell 310	256k, 200ns

playing 256 colours needs 300k. This is why many VGA-compatible boards can offer 640 by 400 graphics in 256 colours, but not the full 640 by 480; the standard 256k video RAM capacity is just not big enough.

As mentioned, timing is crucial in video display hardware. All the timing in the video system is handled by the CRT controller circuitry, often abbreviated to CRTC. For each scan line on the monitor, the CRTC turns the electron beam, or beams, on at the left-hand edge of the screen and then feeds addressing signals to the video signal generator for use in extracting information from video RAM. The information retrieved is decoded according to the text or graphics mode in use, and then converted into video signal information and fed to the monitor to modulate the electron beams appropriately for that particular scan line. At the end of the line the CRTC turns the electron beams off again and sends a horizontal synchronisation signal to the monitor hardware to make it flick leftwards and downwards to start the next scan line, where the same process is repeated. Finally, after the last line of data has been displayed, the CRTC sends a vertical synchronisation signal to the monitor to restart scanning from the top left-hand corner of the screen.

The CRTC also generates timing signals that synchronise the extraction of data from video RAM, and therefore the video signals generated, with the timing signals that the CRTC is sending to drive the monitor hardware. This ensures that the data coming from video RAM does not get out of step with the physical scan lines on the monitor, which would garble the display.

Timing and monitor control are the major functions of the CRTC, but it also performs several other functions in PC video systems. For example, it controls the size and position of the hardware cursor — the flashing underbar cursor

that everybody sees at boot-up, for example — and detects light pen signals if a light pen interface is included on the video board.

All these functional blocks — the video signal generator, the CRTC, the attribute decoder and the character generator — are controlled using registers embedded in the chips making up the physical video system. And all of these registers can be accessed either directly, by writing data to or reading data from the appropriate input/output ports, or via higher-level video BIOS routines that can be called to do the register-twiddling without the programmer having to know anything about the physical hardware involved.

Since a large number of registers are involved — the MDA's 6845 CRTC alone has 19 of them, for example — and they interact in various ways to provide the various display modes, most programmers will go for the simpler BIOS interface to the hardware.

The BIOS interface

Every PC comes with a set of video control routines included as part of the ROM BIOS firmware that drives the low-level hardware of the system, and these support MDA and CGA video boards directly; on the higher models of the PS/2 range, the motherboard BIOS also includes the support routines for the integral VGA chip. However, every EGA or VGA board, from IBM or from anyone else, includes its own extra ROM BIOS firmware to allow software control of the board's video features.

When an EGA or VGA board is plugged into a PC, the power-on routine automatically re-routes video BIOS calls to the ROM on the video board rather than to the motherboard BIOS, although the EGA or VGA ROM BIOS can access the motherboard video BIOS calls if it needs to.

These video BIOS calls are essentially

a means of letting the software drive the video hardware by running small programs stored in the ROM BIOS with parameters supplied by the software. For example, switching video modes on an EGA board can be accomplished by putting zero into a particular processor register, placing the desired video mode number in another register, and then issuing the Int 10H processor interrupt; BIOS function 0, Select Video Mode then executes and sets the appropriate registers in the video control hardware to the right values.

This Int 10H interface to video BIOS routines is standard throughout the PC and PS/2 ranges, regardless of the type of graphics hardware fitted, and the differences between the various graphics standards lie in the functions available to the programmer in the BIOS. Obviously, the way video BIOS routines are accessed, by shoving values into processor registers and then issuing an interrupt, is more suited to assembly language programming. However, the BIOS routines can be accessed from high-level languages like C as long as the compiler supplier or the individual programmer produces a library of video routines that abstract the programmer even further from the actual video hardware.

Despite the power of the video BIOS interface as a lowest-common-denominator way of making software portable by writing to software rather than hardware, many PC programmers tend to bypass the BIOS routines to gain extra speed. In Lotus 1-2-3, for example, the program — written in assembler — was designed to write direct to the video RAM to sidestep the horrifically-slow BIOS routines for writing characters in the original 4.77MHz IBM PC.

The same approach can be used with any video board as long as the programmer is willing to risk assuming that the video RAM will always be in the same address range on every clone board,

VGA test results

Video RAM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Manufacturer
256k, 100ns	X	0	0	X	X	0	0	0	0	0	07,15	0	0	0	X	0	0	0	AST (02) 906 2200
256k, 150ns	0	0	0	X	X	0	0	0	0	0	0	0	0	0	0	0	0	0	Video Seven (Tech Pacific (02) 662 4122)
512k, 100ns	X	X	X	X	X	0	0	0	0	0	07,13,15,16	0	X	0	X	0	0	0	Orchid (Porchester (03) 537 2722)
256k, 100ns	X	X	0	X	X	0	0	0	0	0	07,15	0	0	X	X	0	0	0	Paradise (JIT (03) 720 1333)
256k, 120ns	0	X	0	0	X	X	X	X	0	0	0	0	0	X	X	X	X	X	Video Seven (Tech Pacific (02) 662 4122)
256k, 120ns	X	X	X	X	X	X	X	0	0	0	0	X	0	0	X	X	0	0	Compaq (CCA (02) 660 0077)
256k, 100ns	X	0	0	X	X	0	0	0	0	0	07,15	0	0	0	X	0	0	0	Amstrad (02) 360 3144
256k, 100ns	X	X	X	X	0	0	0	0	0	00-13	04,05,07,15	0	X	0	X	X	0	0	Wyse (MPA (02) 894 1500)
256k, 100ns	0	0	0	0	X	0	0	0	0	0	0	0	0	0	X	X	0	0	Video Seven (Tech Pacific (02) 662 4122)
256k, 120ns	0	0	0	0	X	0	0	0	0	00-13	0	0	0	0	0	0	0	0	Video Seven (Tech Pacific (02) 662 4122)
256k, 120ns	X	0	X	0	X	0	X	X	X	0	0	0	0	0	X	0	0	0	Compaq (CCA (02) 660 0077)
512k, 100ns	X	0	0	X	X	0	0	0	0	0	0	0	0	0	X	0	0	0	Paradise (JIT (03) 720 1333)

• The **Manufacturer** column gives the name of the company who made the video card and the Australian distributor.

• The **Chip Set** column lists the source of the two main VGA chips — the CRTC controller and the colour look-up table.

The 18 tests have been developed by a number of companies to show what VGA compatibility actually means. A cross (X) means the test was failed, while a zero (0) shows the test was passed.

The tests

The individual tests were written by the following companies:

Chips and Technologies (Tests 1,4,5)
Video Seven (Tests 2,3)
Renaissance (for Chips and Technologies) (Tests 6,9)
Paradise (Test 10)
US PC Magazine (Tests 11-18)

Test 1 Checks that it is possible to not only write data to the VGA latches, but also to read it back again.

Test 2 Checks that the card and monitor can cope with increased scan rate generated by the speeding up of a moving graphic symbol.

Test 3 Tests the ability of the VGA to set up a split screen and then smooth scroll an image from right to left and back again. This test is performed in VGA mode 12 hex (18 decimal).

Test 4 Smooth scrolls a 640 by 400 bitmapped image.

Test 5 Loads a 1280 by 400 image.

Test 6 Checks for the ability to perform a smooth scroll with a split screen in VGA mode 13 hex (19 decimal).

Test 7 Checks the ability of the VGA to move a line down the screen, simply by changing the start address of the screen memory.

Test 8 Checks that all 256 standard IBM-defined VGA characters are available in text mode.

Test 9 Checks that all 256 colours are present in VGA mode 13 hex (19 decimal).

Test 10 Checks that all the registers contain the correct values when each VGA mode is initialised. It also checks that the values placed in the registers by the custom video BIOS are correct.

Only the tests that failed are listed in hex.

Test 11 Checks that all the possible VGA modes are usable. Only the tests that failed are listed in decimal.

Test 12 Tests the video DAC (digital-to-analogue convertor) by writing directly to the colour palettes.

Test 13 Tests all the VGA write modes including colour fill, set/reset, rotated, and the logical modes of AND, OR and XOR.

Test 14 Checks that the correct timing information is generated at the end of every vertical scan and compares this with the system clock every second.

Test 15 Checks that the vertical blanking information is being generated 60 and 70 times a second, and compares the results with the system clock every second.

Test 16 Pans and scrolls the same piece of text so that it follows a diagonal path across the screen.

Test 17 Creates an inverted programmable character set and checks that it is used correctly.

Test 18 Checks that a variable sized, split screen, smooth scroll can be performed in a low-resolution mode.

and that every register in the CRTC and the rest of the functional blocks is in the right place, has the right format and interacts with other correctly-configured registers to do the job required. It is the prospect of programmers willing to take these risks in exchange for higher performance that has driven the quest for register-level compatibility as the minimum requirement for today's VGA-clone video hardware.

VGA hardware

The VGA chip in PS/2 Models 50 and above is, as far as the system is concerned, a black box that accepts video BIOS commands as input and produces

displays on a monitor as output. Internally, however, it includes all the functional blocks already described, although in typical IBM fashion it gives some of them different names.

The main blocks are the CRTC, the attribute controller (ATC), the Graphics-Data Controller (GDC) and the Sequencer. Just to map these onto the names given earlier — the CRTC and the ATC are obvious; the GDC handles all transfers of data between the central processor, the 'latches' that the VGA chip uses to store data retrieved from video RAM temporarily, the ATC and the video RAM itself; and the Sequencer generates the internal timing required to extract data from the video RAM in synchronisation with the CRTC.

These names and functions may possibly be familiar from the EGA standard and, indeed, the two standards have a lot in common internally. The major external difference is that while the EGA hardware was implemented on three chips, with the GDC alone taking up two of them, every VGA function apart from the video RAM is implemented in a single big custom gate array built onto the PS/2 motherboard or on IBM's VGA adaptor for older PCs.

Each of the VGA functional blocks has a set of programmable control registers built in, and there is also a set of general-purpose registers that can be accessed. The register set includes 25 registers in the CRTC, six in the Se-

quencer, 10 in the GDC, and 22 in the ATC, with the general-purpose registers adding six more to the list.

The intriguing thing about the VGA register set is that it is fundamentally the same as that of the EGA standard. Plug a VGA board into a PC, tell the PC that an EGA board has been installed, run software that writes direct to EGA registers and everything should still work fine. Naturally, running VGA-specific software will activate the new display modes and features.

The EGA compatibility is not absolute, however. Some EGA registers like those supporting the light pen have gone, previously unused bits in some others are now used, other registers have had extra bits added to handle the extended text and graphics mode, the hardware cursor works in a different way and, of course, the horizontal and vertical timings and the way colour is handled are different.

IBM has done its best to replicate the EGA hardware, only extending it where necessary. For example, the EGA standard only has a choice of 64 colours and these are reproduced in the VGA chip using an internal palette, which is then mapped onto the external palette chip, the Inmos G1712 DAC. In fact, the external palette holds the entire 64 colours of the EGA set and any 16-colour group can be selected for display under software control. Even the bugs in the EGA have been replicated for compatibility; for instance, the EGA horizontal panning bug which causes the first character of a panned split-screen to slide off the screen to the left has been reproduced in the VGA chip, although this 'bug support' can be turned off by changing a bit in an ATC register. This is done so that EGA software, which writes to the hardware and corrects for the expected bug, will still work correctly on the VGA.

The most important difference between the EGA and VGA software is probably that all the VGA registers can be read as well as written. This is important for multi-tasking applications, where the operating system wants to perform fast context-switching between different applications with different screen displays, since it makes it possible to store the contents of the registers — save the video state, in the jargon — and then rewrite them to switch displays quickly. Different display contexts are mapped to different sections of the DAC, so that during a context switch the operating system can designate the right portion of the DAC with a single instruction and avoid the slow reloading of the DAC registers.

But the VGA hardware has not gone quite far enough to make context switching a trivial matter, since not every part of the video is accessible to be saved. For example, the temporary storage latches in the GDC cannot be read directly, and an important register bit in the ATC cannot be preserved if an interrupt occurs, so that programs directly accessing the ATC must disable interrupts while doing it. The PS/2 Model 50 BIOS, for example, works like this.

Other differences between the EGA and VGA standards are more trivial. The Sequencer now allows up to eight screen fonts rather than the four of EGA, although the EGA limit of two fonts displayed at any time remains. This means that the 8 by 8 and 8 by 14 fonts included for CGA and EGA compatibility can be joined by a new 9 by 16 font for higher text quality. This new font — with the distinctive dot in the middle of the zero — is the default 80 by 25 text font in VGA systems.

Overall, there are some disappointments in the VGA hardware implementation, most of them brought about by the need for backward compatibility with the earlier CGA and EGA standards, but

VGA BOARDS

some of them rather hard to understand. For instance, it is difficult to see why the VGA chip is still an 8-bit device, particularly when all the machines that IBM uses it in are at least 16-bit, and extra wait states are introduced when the 16-bit bus accesses the 8-bit video RAM.

Secondly, there is no support for a graphics cursor — the pointer in Microsoft Windows, for example — or windowing in hardware. In highly-interactive applications like Windows, an astonishing 20 per cent of CPU time is spent handling the graphics cursor in software, since the program needs to remember the screen contents under the cursor at any instant and update the screen when the cursor moves.

Finally, the use of four 64k 'bit planes', as in the EGA standard, limits the 256-colour display resolution severely; we shall return to this when considering the VGA-compatible boards from third-parties.

However, the VGA hardware provides extra functions and modes, and the preferred route for accessing them is through the VGA video BIOS. But, of course, programmers can still do it themselves if they know precisely what they are doing.

The VGA BIOS

The VGA BIOS is built into the motherboard of PS/2s, and the EGA compatibility mentioned means that on VGA-compatible expansion boards the video BIOS routines fit into the PC's memory map at the same locations as the normal EGA BIOS ROMs. There is nothing spectacularly new in the VGA BIOS itself, nothing to support any graphics-drawing procedures other than placing a single dot on the screen, for instance, and all the extra features of the VGA hardware are handled by changing the parameters fed to BIOS routines already familiar from earlier graphics standards.

As an example, video mode switching is done by putting a number representing the required mode into a register. In the VGA BIOS, putting 11H, 12H or 13H into the register sets up the new 640 by 480 two-colour, 640 by 480 16-colour, and 320 by 200 256-colour modes. Putting these values in the register with an EGA BIOS will do nothing. Similarly, the old BIOS function 10H has some extra options to handle the VGA DAC colour registers, again selected by putting particular values into CPU registers.

The disappointing thing in the IBM VGA BIOS implementation, is that there are no extra functions to do things like draw lines, fill screen regions and move

Graphics standard	Dot clock, MHz (Video bandwidth)	Scan Rate (Horizontal, kHz)	Scan Rate (Vertical, Hz)
MDA, Hercules			
720 x 350	16.257	18.43	50
CGA			
640 x 200	14.318	15.75	60
EGA			
640 x 350	16.257	21.85	60
640 x 200	14.318	15.75	60
720 x 350	16.257	18.43	50
MCGA			
640 x 400	25.175	31.50	70
640 x 480	25.175	31.50	60
VGA			
640 x 400	25.175	31.50	70
720 x 400	28.322	31.50	70
640 x 480	25.175	31.50	60
640 x 350	25.175	31.50	70

Graphics frequencies: must be supported by VGA boards for full backward compatibility

blocks of bits quickly from place to place. It is compatible with the EGA BIOS though, and EGA compatibility seems to have been one of IBM's prime design goals for the VGA standard.

Compatibility issues

Naturally, VGA compatibility was the main design goal of those companies aiming to produce VGA boards for existing PC users. As we have seen, there are two basic compatibility levels — BIOS level and register level — and both hold problems for board designers.

BIOS-level compatibility was fairly simple to implement given its similarity to the EGA BIOS and the fact that every board maker had a ready-written EGA BIOS on tap, either from Phoenix or developed internally. The problem lay in mapping the new extended VGA BIOS routines onto the underlying hardware, which on early VGA boards was usually an enhanced EGA chip set from Chips and Technologies. These chip sets did not have some of the specific functions of the VGA chip, although they did have some of the VGA modes such as 640 by 480 in 16 colours, and it was inevitable that some VGA modes and some VGA BIOS routines could not be emulated on the hardware available. For example, the 320 by 200 256-colour mode introduced in VGA was something that the extended EGA chip makers had never thought of and so could not be implemented at all on BIOS-level VGA boards.

However, the VGA BIOS was fully documented for software developers, with all its calling protocols defined, and extending an existing EGA BIOS to cover the changes was not too difficult. Some board makers even extended the BIOS beyond IBM's design to put in higher-level support for panning, scrolling and zooming in on parts of the video RAM, which are all possible on both EGA and VGA hardware, but normally need a lot of low-level programming in applications. Building the hardware that could be driven by the BIOS, or driven directly by software aimed at the VGA hardware, was much trickier.

The major problems for those attempting to clone the VGA hardware down to register level involved the scale of the task and IBM's determination to protect its intellectual property. By implementing the functional blocks of the VGA video system on a single big gate array, bigger and more complex than most of those used by other PC manufacturers, IBM made it simultaneously difficult and expensive for chip set manufacturers to duplicate its functions. They could not simply dismantle the VGA chip, get a blank gate array the same size and make exactly the same connections as IBM had, because that would be an obvious copyright violation. Instead, they had to work out the internal logic of the chip, the positioning, size, usage and inter-relation of all its hardware registers and then produce a 'black box' chip that accepted the same inputs and used them to produce the same output as the original IBM hardware.
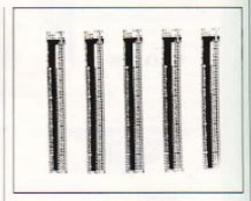
This type of 'clean room' approach is familiar from the early days of PC cloning, where programmers were required to take a list of functions that the IBM BIOS performed, write software with the same calling protocols and entry points to do the same jobs, and then adjust the code to remove any incompatibilities found during testing — without even looking at the complete BIOS listing IBM provided to prevent any possible charges of copyright violation.

But without duplicating the hardware down to the transistors, there is no way for VGA-compatible chips to promise 100 per cent compatibility with the IBM version. What goes on inside chips is incredibly complex, and such trivial effects as the capacitance between adjacent signal paths, or a slight delay in a signal passing from one register to another, can prevent a VGA-compatible chip from duplicating some IBM VGA functions exactly. These effects might not show up in a gross way, as long as the chip's initial design matches the register layout and operation of the VGA chip, but may show up in subtle ways over time as more and more VGA-specific software appears.

However, there are compensating advantages for VGA-compatible chip makers in that they can put right some of the things missing from the IBM chip. For example, the reason IBM's 256-

Mono 640x400 spreadsheet test failure

colour mode is only available at a resolution of 320 by 200 is because of its slavish dedication to EGA compatibility. In 256-colour mode, each pixel needs eight bits of data to specify its colour, either by placing a byte of data for each pixel in video RAM or by using eight parallel 'bit planes' where one bit of the eight bits of colour information comes from each of the planes. But IBM has only included support for the four-bit planes of the EGA standard, so the byte-per-pixel in video RAM method must be used. And since the VGA chip has a limit of 64k per memory segment, although higher 256-colour resolutions would fit in the standard 256k, only 320 by 200 pixels (62.5k at a byte per pixel) are possible in 256 colours.

The EGA chip makers, on the other hand, had already implemented eight-bit planes in their extended EGA products, making 256-colour displays a possibility in every display mode as long as there was enough video RAM available. As a result, VGA boards with the standard 256k of video RAM tend to offer 640 by 480 in 256 colours and can go even

A typical hardware scroll test failure

higher depending on the modes they choose to implement. This reduces hardware compatibility, however, since changing the memory segmentation structure of the CRTC obviously means it will not mimic every last hardware function of the IBM CRTC.

Designing a new chip also gave the VGA-compatible chip makers the chance to add new modes to support users of multi-scanning monitors, and to add extra compatibility with earlier graphics standards. For example, the Paradise PVGA1 chip includes 800 by 600 modes in monochrome or 16 colours and 960 by 780, 1188 by 350, 1056 by 344, 1056 by 770 and 1024 by 768 modes in monochrome only for 132-column text alongside a 640 by 480 or 640 by 400 mode in 256 colours, all depending on video RAM capacity. The chip also offers Hercules and AT&T/Olivetti compatibility, which IBM obviously does not, and the expected CGA, EGA and MDA compatibility.

Oddly enough, given the built-in EGA compatibility of the IBM chip, the PVGA1 only promises 100 per cent BIOS-level compatibility with EGA rather than true register-level compatibility. Presumably, this is due to the necessary alterations in the CRTC memory addressing to get the higher-resolution 256-colour modes.

The main drawback to the extra display modes available is that software written for the EGA or VGA standards will not make use of them. As a result, the board makers must write their own software drivers for packages that allow this; the standard set includes Lotus 1-2-3 and Symphony, Autodesk's AutoCAD, Windows 2.03 and Windows/386, Gem and the Ventura version of Gem, and 128-column or 132-column modes for text-based software like WordStar and Word-Perfect.

Testing the first register-level VGA boards was an interesting process. Early chips like those produced by Video Seven certainly did not have full register-level compatibility, and tended not to work properly with their own extended video modes. However, as the chip makers delved deeper into the IBM VGA hardware, compatibility improved until it is now unusual for VGA boards to fall over spectacularly when running such notorious BIOS-bypassing graphics programs as Microsoft Windows in all its incarnations.

The Paradise PVGA1 chip, now in its second version as the PVGA1A, the Tseng Labs 11051AG, and the new Chips and Technologies 82C441 are all now being used either on VGA add-on boards or on the motherboards of systems like the new Apricot Qi or the Compaq 386s and SLT/286, and all run VGA applications flawlessly.

But incompatibilities still exist, and there is still no VGA chip that exactly matches the IBM VGA in every particular. We have seen that full hardware compatibility is unlikely, given the necessary changes to support higher-resolution modes and backward compatibility with Hercules modes, for example; but no board yet passes every compatibility test as our table shows.

The reasons for these failures are complex, and probably caused by interactions between registers and timing problems. For example, the diagonally-scrolling test should work smoothly as long as the horizontal and vertical positioning registers are written to simultaneously; the jerkiness visible on almost every board is caused by writing to the registers one after another. Similarly, horizontal panning should work with no visible screen interference as long as the three registers involved in the process — the Horizontal Pel Panning, Preset Row Scan and Start Address registers — are updated in synchronisation with the monitor control signals. Just to make things more complex, the three registers must be updated at different times in the monitor scanning process, and any slight timing error can produce screen flicker or jazziness — just the faults found in many boards using our horizontal panning tests.

Other failure modes could be due to incorrect addressing of the DAC palette registers from the ATC, or the simple omission of some VGA modes from the CRTC register set, with modes 7H and 0DH causing the most trouble. But almost all the faults found in claimed register-level compatible chip sets and boards can be put down to timing and synchronisation problems, even if the right registers are there and they are working correctly — a conclusion that seems to be confirmed by the fact that

boards based on the same chip set can fail in different ways.

So, even a board that fails some of the VGA tests is not automatically register-level incompatible; just hardware-level and timing-level incompatible. And the situations tested for by most of the tests will rarely crop up in commercial applications, which tend either to use the video BIOS wherever possible and eschew clever hardware-level tricks that might not work on later chip revisions from IBM or on clone chips from other suppliers.

The boards

The range of VGA-compatible boards tested here varies in price, function and compatibility, but they are all based on one of three register-level compatible chips from Paradise, Tseng Labs and Video Screen. The tables show the extra modes provided by each board and the software drivers provided to handle them, while the test results show the variation in compatibility.

Some of the boards require special consideration. The Orchid Designer VGA, for example, comes with 512k video RAM as standard and supports 1024 by 768 resolutions in four colours, and also has an extended video BIOS to provide easier access to the panning and zooming features of its Tseng Labs chip.

Video Seven's VRAM VGA board uses dual-port video RAM chips to speed up operation, letting the display refresh hardware and the CPU access video RAM simultaneously. Normally, the display refresh hardware has preferential access and the CPU must hang around waiting for its turn. The VRAM VGA cuts out these extra CPU wait states for faster performance.

Most of the boards offer the same things: all the new modes of the VGA standard with backward MDA, CGA, EGA and Hercules compatibility. In most applications, all of them do their job well.

The tests

The VGA compatibility tests used came from a variety of sources. Some are public-domain benchmarks, but most come from VGA-compatible chip makers aiming to prove that their chips are compatible and that others aren't. This should be borne in mind when considering the test results. But in passing, Tseng Labs gets full marks for distributing Paradise's VGA compatibility test to its OEMs, even though it gets fewer points for saying that two of the tests are bound to fail because the Vertical Retrace End Register in the Tseng chip has its sixth bit inverted, and because in one mode the chip returns the wrong number back from another of its registers.

It is worth re-emphasising that failing these tests does not mean that a board will not run VGA applications, such as Windows, successfully. It does mean that low-level hardware programming that bypasses the video BIOS may find some problems if it tries to do certain things, and it is fairly unlikely that they will be done by application programmers.

However, the results do show the difficulty of reproducing the functions of an IBM chip without violating any copyrights, but still including compatibility with every graphics mode that has ever been used on a PC.

The VGA chip provides a video history of the PC business, and one comfort for the future is that we may finally see the end of the horrific 8 by 8 characters and pink and cyan tones of the CGA standard. That would be almost worth the disruption and confusion of yet another complex new graphics standard from IBM.

END

Amstrad PC20

In this exclusive review, Steve Withers looks at a pre-release version of Amstrad's $899 PC compatible, the Amiga 500-style PC20.

A pre-release review is never easy, and this one was no exception. There are many things that help determine a reviewer's overall impression of a finished product, and when some of them are missing it can be difficult to draw firm conclusions. Indeed, it may even be risky to make statements, as the facts can change before the product reaches the shops.
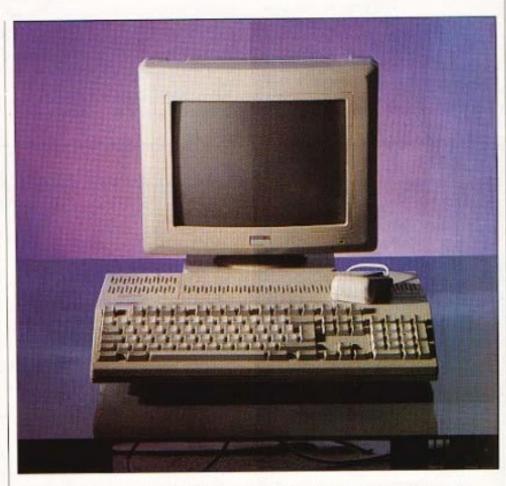
However, it has always been *APC's* policy to present benchtests that accurately reflect the review hardware and software. I'll follow that tradition, but in doing so I'll remind you in appropriate places of the pre-release nature of the system. One thing that should be noted is that *two* computers were provided for review; the first was a pre-production sample of the Australian version, the other was in the form that it is sold in the UK.

Although the remains of Clive Sinclair's computer business were purchased by Amstrad, his name lives on. The British version of the PC20 is marketed as the Sinclair PC200, and indeed the power-on message displayed by the PC20 still identifies itself as a Sinclair product.

Hardware

Probably the simplest way of describing the PC20 is to call it a PC-compatible in Amiga 500-style packaging, although the resemblance to the Amiga is little more than skin deep.

Apart from the monitor — which is an optional extra anyway — the PC20 is a self-contained unit. Connect a display and plug into the mains, and it's ready to go. A nice feature, since the system appears to be aimed at the domestic

Although the mouse is standard equipment, the colour monitor adds $300 to the total price

market. As the machine looks like an overgrown keyboard, I'll start with a run-down of the keyboard. The layout is the now-familiar 102-key format. Whether that is advantageous depends largely on the software used, especially with the use of SHIFT, ALT and CTRL to modify the effect of function keys. On the pre-production machine a few characters seemed to be in the wrong place, but pressing most of those keys generated the 'right' character. Incidentally, the legends are printed on the keytops, and so may wear off after heavy use. Two-

shot mouldings are preferable, but the cost is higher.

The 'feel' of the PC20's keyboard is run-of-the-mill. Its downfall, however, is the absence of progression in the springs — unless you have a very light touch you will find the keys bottom out with quite a jar. Unfortunately, the same can be said for many other low-cost systems. Raised 'pips' on the home keys are a feature that touch-typists may appreciate.

As a result of the one-piece design, the keys sit much further above the desk than most authorities would recommend. However, given that home computers are usually less intensively used than office systems, this is not a major consideration.

Like some other Amstrads, the PC20 uses the 8086 processor. At one time, '8086' and 'fast' always seemed to appear in the same sentence, but in these days of '386-based systems that adjective no longer seems so appropriate, even with a 10MHz clock. The new *APC* benchmarks are designed to give a good indication of a system's performance in real-life situations, but because of the Amstrad's entry-level configuration it seemed unreasonable to attempt the high-level tests (you just don't use Page-Maker without a hard disk!).

As the low-level index relates the machine under test to an IBM PC/XT with a hard disk, the Amstrad is handicapped by its floppy drive.

The decision to build the machine with only 512k of memory is unusual. Even

'If you are looking for your first MS-DOS system and are prepared to sacrifice some expandability for price, then the PC20 should be on your list.'

though the PC20 is aimed at a particularly price-sensitive market, the advantage of a full 640k would outweigh the relatively small extra cost. Although buyers of this system are less likely to run memory-hogging software, any surplus can be used as a RAM disk. Such an arrangement is particularly useful in a single-drive system like the PC20. Still, the 512k formula seems to have served Amstrad well in earlier machines.

In the absence of a metal case, virtually all the motherboard is shielded. The large number of fastenings make it difficult to see the layout of the board, but its small size suggests the use of VLSI chips. In fact, the board is not even fully populated, presumably reflecting a design that provides for assembly in more than one form.

The single disk drive mentioned above is a 720k, 3.5in unit mounted in the right-hand side of the case. In common with other systems with side-on drives, a repeater for the 'drive active' light is provided on the top of the case. All very sensible, but because the light is on the opposite side of the case to the drive, I often found myself forgetting to check it. In my experience, most problems novices have with corrupted disks can be attributed to their removing them from the drive at the wrong time, so this apparently minor weakness could have a significant effect.

A connector on the back panel allows the connection of a second (external) drive which may be either another 3.5in unit or a 5.25in, 360k drive. The connec-

tor itself is of the kind normally associated with parallel printer interfaces, while a DIN socket provides the power. This bears a distinct resemblance to the arrangement on Amstrad's recently announced 2000 series. It may be possible to install a hard card (a hard disk mounted on its controller), but there is no other provision for a hard disk.

Accompanying the floppy disk interface are the usual printer and serial ports, plus connectors for monitor and television. The joystick and mouse interfaces are unconventionally mounted *under* the keyboard. Although this arrangement seems strange, it does make sense. These two devices are generally permanently attached (you don't need to unplug a mouse when moving a computer, but a printer is a different story), and moving the socket towards the front of the case effectively lengthens the cable.

The mouse is supplied as standard equipment. Although I have been a fan of the 'rodentiometer' for years, I was unimpressed by this example. My hand did not fit comfortably around its wedge-shaped body, and the lack of low-friction pads or rollers meant it did not slide easily.

The PC20's display is purportedly compatible with the colour graphics adaptor and the monochrome display adaptor, but only a colour monitor was provided. The colour monitor is a $300 optional extra, which is certainly a competitive price. It was hard to determine the overall quality of the monitor, because the convergence was poorly adjusted. Like the PC20, the monitor was a pre-production sample, so take a look at a real one in a local showroom and draw your own conclusion.

I was impressed by how well the system worked with a TV instead of a

From left to right: external disk power and signal connectors, TV and monitor sockets, parallel and serial ports

This view of the well-shielded motherboard also reveals the limited space for expansion

monitor. In 40-column mode the individual characters were very dense and clear, and when I switched to 80 columns I was pleasantly surprised by the legibility of the display.

Now, I'm not suggesting that it is anywhere near as good as a monitor, but conventional wisdom says a monitor is mandatory for 80-column displays. If most of your work is in 80 columns you should buy a monitor, but a TV could suffice if you only occasionally need the full-width display.

The absence of a composite video output was surprising. Unless you live alone or have a second set, there is normally too much competition for the TV to make it your regular display. If you are on a budget (as many potential buyers will be), a composite monitor for around $100 would otherwise be the cheapest option.

One feature of the PC20 that should be standard on all computers is the volume control. Whether you're working at home or in an office, the ability to regulate the sound is a blessing. Despite being fitted with a very small speaker, at full volume the PC20 emits enough sound to keep the dedicated gamer happy, and by turning it down you can still hear what's going on without disturbing the person sleeping in the next room.

Expansion

Turning to the possibilities for expansion, the top right-hand section of the case hinges open to reveal the system configuration switches, a vacant 8087 coprocessor socket and two full size expansion slots. On second thoughts, 'full length' would be a more accurate description as the bay is only five centimetres deep, which is much shallower than an expansion board. Apart from giving an untidy appearance, this design also means that there is nowhere to attach the mounting brackets that normally keep add-on boards securely in place. There seems to be a significant risk of damage to both the boards and the flimsy-looking hinges of the lid, not to mention a good chance of radio frequency interference from the unshielded circuitry.

A replacement lid could be produced, but it may not be aesthetically pleasing.

Documentation

The quality of documentation is always an important consideration. Novices require clear 'how to begin' instructions, while more expert users may need detailed technical material. Unfortunately, no documentation was available for this review, due to the newness of the machine.

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Software

The review system was accompanied by a copy of MS-DOS 3.3 for the PPC512/640, a 'Show Partner' presentation of the earlier Amstrad computers and GEM. There is probably nothing new left to say about DOS 3.3, so I'll simply say that it worked.

Show Partner ran uneventfully, but GEM completely ignored the mouse. Whether this was due to incorrect configuration or a hardware problem remains a mystery, largely because of the absence of documentation.

Amstrad advised me that the PC20 will be sold with DOS 3.3, GEM, Typing Tutor, Decision Maker, Memory Builder, Speed Reader, Home Office Writer, Home Office Filer, Gunforce, Backgammon, Space Vaders [sic] and Bricks. Since those programs were not made available for this benchtest, I am unable to comment on their quality or usefulness, but they certainly cover the applications commonly associated with home computing. Assuming they are at least reasonably good, Amstrad must be praised for providing a package that the first-time buyer can take home and put to use without making additional purchases.

Conclusion

There are two questions in my mind. Firstly, if someone wants a MS-DOS system, will the low price be enough to attract them to the PC20, or will they spend another one or two hundred dollars on a conventional clone (or even one of Amstrad's other models)? Such a system would probably have the extra

Technical specifications

Processor:	8086, 10MHz
Main RAM:	512k
Mass storage:	Single 720k, 3.5in floppy drive
Standard I/O:	One parallel port, one serial port, one monitor port, one TV port, one external floppy port, one joystick port and one mouse port
Keyboard:	102 keys
Display:	CGA in three modes: 40 by 25 or 80 by 25 in 16 colours; 320 by 200 in four colours; 640 by 200 in two colours. Colour monitor $300
Expansion:	Two PC compatible slots
Operating software:	MS-DOS 3.3, GEM

RAM and a clock/calendar, and adding the very important second disk drive would almost certainly be cheaper. On the other hand, the Amstrad's compact size will be an important advantage to some, and the 3.5in disk is a big plus for anyone using that format.

Secondly, will buyers as yet uncom-

Benchmarks

Amstrad PC20

Usability index	3 (limiting factor: slots)
Disk tests	0.43
Video test	1.56
Memory test	2.34
CPU test	2.24
Low-level index	1.37

For an explanation of these Benchmarks, see the article 'Benchmarks revisited' elsewhere in this issue.

mitted to a particular style of computer choose the PC20 over the Amiga 500? Again, the 500 costs about $100 more, but I think many people buying for recreational purposes would pick the Amiga for its superior graphics and sound capabilities.

If you ask a simplistic question like 'which computer should I buy?', or 'which is the best computer?' the answer is always the same — 'it depends on what you want to do'. If you are looking for your first MS-DOS system and are prepared to sacrifice some expandability for price, then the PC20 should be on your list.

Amstrad seems to be betting that there are enough people sufficiently sensitive to prime cost to allow the company to ship the PC20 in the volume it expects without cutting into the sales of its more expensive systems. However, since there isn't that much difference in price, the company might not get the result it anticipates.

END

The presentation pitch

Desktop Presentation has risen from being just a marketing gimmick to spawn a whole new genre of software. Robert Wiggins put the three top Macintosh slide-making programs through their paces.

The graphics capabilities of the Macintosh make it so well suited to preparing presentations that when the term 'desktop presentation' appeared, the real surprise was that it had taken so long to show up. The first presentation package, just two years ago, was MORE, which was the sequel to the popular outliner ThinkTank. MORE added the ability to prepare bullet charts from outlines. A few months later, PowerPoint followed — the first slide-oriented package with the ability to print slides, pages of notes and handouts.

The desktop-presentation market might have grown slowly from there, were it not for the Macintosh II, with its excellent colour capabilities. As an added attraction, film recorders that shoot 35-millimetre slides began coming down in price. With a new colour Macintosh and affordable colour-output devices, the hardware was practically begging for more powerful presentation software.

Microsoft, which had acquired the company that produced PowerPoint, responded to the demand for colour with PowerPoint 2.0. Cricket, long known for its graphics software like Cricket Draw and Cricket Graph, entered the fray with Cricket Presents. Manhattan Graphics and Letraset, the team responsible for the desktop-publishing package Ready,Set,Go!, produced ReadySet-Show. [*At press time, Letraset had decided to change ReadySetShow's name to StandOut!. Until the inventory is replaced, the program can be bought under both names — Ed.]* By the time you read this, Symantec's Living Videotext division should be shipping

> 'All three programs offer flexible output . . . let you create and print note pages . . . and print handouts of the slides.'

MORE II (see the box 'MORE II charts new territory'), and Aldus may be shipping Persuasion. Desktop presentation is here to stay, and all these packages are very good.

Slides

The three colour presentation packages available at press time were PowerPoint, Cricket Presents and ReadySetShow. These three have more similarities than differences, so let's look at the overall picture first.

The basic element of a presentation is a slide (Cricket Presents calls it a frame), which is essentially a page. A collection of slides is a presentation, which is the document created by the programs. Slides can be different shapes and sizes, depending on the output device they will be printed on, but all the slides in a particular presentation are the same shape and size, generally either 35-millimetre or 8.5 by 11 inches. Slides can be arranged in any order, and all three packages offer both visual sorting and sorting by slide title. Slides can also be copied from one presentation and pasted into another.

You can place various objects on a slide by using drawing tools that make objects like ovals, circles, rectangles and squares. All three programs have text objects for entering and formatting text information. If you're familiar with drawing programs such as MacDraw, SuperPaint or Cricket Draw, the drawing environment of these programs will be easily mastered.

Objects placed on slides are layered, which allows flexibility in placement. The back layer of a slide can consist of a master slide, and all other objects will appear in front of this background. Objects with solid fills obscure objects behind them, although all three programs offer transparency as a fill 'colour' so that objects in the back can be seen through foreground objects if so desired.

All three programs offer flexible output. Slides can be printed on any standard printer in black and white, or on a colour-

MORE II charts new territory

We got a sneak preview of a pre-release version of MORE II, and since it should be available by the time you read this, it deserves more than a passing mention.

MORE II adds many new features to its outliner, but of more interest are the extensive enhancements made to its bullet chart environment. As with the original MORE, bullet charts can be generated automatically. Once a chart is created, though, a drawing environment like that of the other presentation packages is available, and MORE II has all the features common to the other programs except a visual slide sorter, since the slide order is determined by the outline.

MORE II offers many drawing tools and functions in full colour. MORE II also has alignment, centring and grouping of objects. Because of the underlying outliner, MORE II has most text-handling features, including a spelling checker. MORE II has a feature called 'rules' that is a powerful style sheet with

different rules sets available in the outline, bullet chart and tree chart modes. Using rules, an outline can be displayed in the Times font at 12 points with black text on a white background, while the same text on the charts is Helvetica 36-point yellow text on a blue background.

MORE II's best feature is its slide show, which is far more powerful than the other presentation packages. It's designed so that a presentation on a multiple-monitor Macintosh II can be made on one monitor facing the audience while the speaker sees a control panel and notes on a second monitor. The control panel keeps track of the overall time of the presentation, the time a slide has been up, and tracks these against a budgeted time. MORE II offers several different 'build' capabilities so that various items on a chart can be highlighted in turn as each is discussed.

For the ultimate in on-screen presentations, MORE II supports the Kodak ADB remote-control unit that allows the

speaker to be away from the Macintosh and still control the show, including random access to charts (very helpful when the boss wants to go back to a previous slide).

Another advantage of MORE II is its extensive import and export capability of both text (Word, MacWrite, ASCII text, ThinkTank, MORE, GrandView) and graphics (PICT, Paint, EPSF). MORE II also offers open architecture translation drivers so additional file formats can be added easily in the future. MORE II uses virtual memory, so the size of your presentation is limited only by available disk space.

When you're deciding which presentation product to buy, be sure to take a look at MORE II. If most of your presentations will be made on a Macintosh screen, MORE II will be your best choice. MORE II is expected to ship mid-December, however at the time *APC* went to press, prices were unavailable.

MORE is available from PC Extras, tel: (02) 319 2155.

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output device like a slide recorder with an appropriate Chooser driver.
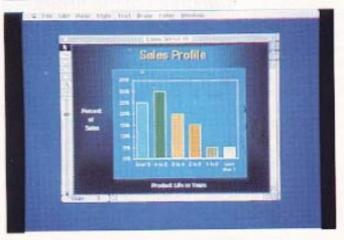
All three programs print handouts of the slides, with a choice of the number of slides per page. All three also let you create and print note pages, which have a small version of the slide and any speaker's notes that you care to add. You also can use the Macintosh screen to display a slide show. The on-screen slide show feature is most useful on a large colour monitor attached to a Macintosh II or with one of the overhead projection units that have come onto the market during the past year.

While all three programs share these similarities, they all have their distinguishing characteristics. Let's look at each of the three in turn.

PowerPoint

PowerPoint 2.0 is not all that different from its original version. The major change is the addition of colour, and here Microsoft has provided an exceptional feature. Genigraphics, an experienced slide-preparation company, has designed a variety of examples and chosen some attractive and effective colour schemes. Microsoft has added special support for colour schemes, so it's possible to take an existing presentation (either black and white or colour), select a new colour scheme, and have it

One of the hardest things to select, especially for non-artists, is an attractive and effective colour scheme. PowerPoint comes with many predefined templates, designed by professional artists

PowerPoint has no integrated charting facility, so the chart on this slide was created in Excel, then copied and pasted into PowerPoint. All the colour attributes of the chart were defined in Excel

automatically applied. This makes it easy to create an attractive presentation, even if you have no artistic ability or are colour-blind.

Text handling has been substantially improved with the addition of find-and-replace logic and a spelling checker. The ability to import ThinkTank and MORE

outlines and automatically generate slides is still included.

PowerPoint's weakness remains the same in version 2.0 as in the original — the drawing environment. PowerPoint offers the fewest types of drawing tools (see the 'Slide-making software shootout' chart), with no charting capabilities at all. The biggest drawback is the lack of alignment and grouping capabilities. Objects must be aligned with one another manually, and shift-selected or drag-rectangle-selected before they can be moved as a group.

Despite its paucity of drawing tools, PowerPoint can be used to make some spectacular slides. Several examples prepared by Genigraphics show novel

and unusual effects combined with imaginative colour. With its colour schemes and text style sheets, along with the Genigraphics-designed examples, PowerPoint makes it easy to quickly produce attractive and striking slides. If all goes according to plan, Genigraphics Australia will next year be offering an interface to Masterpiece film recorders for the production of 35mm slides.

Cricket Presents

Presents shares many features with its fellow Cricket products. The drawing environment shows the influence of Cricket Draw, and the charting capability is reminiscent of Cricket Graph. This is both good news and bad news, depending on how you feel about the Cricket interface — Cricket products often require that you click on things where other programs would use menus.

Because of its heritage, Cricket Presents offers the widest range of drawing tools of the three programs. Presents also has complete object-alignment, centring and grouping capabilities. It's not a replacement for Cricket Draw or MacDraw, but you'll seldom need more drawing power for creating slides.

Presents also has an integrated charting facility that makes constructing simple and even some complex graphs quick and easy. Again, it's not a replacement for a full charting package like Cricket Graph or even Excel, but for modest charts it gets the job done.

Presents even has a table tool for creating spreadsheet-like tables quickly and easily. No spreadsheet functions are included, but it's easier than laying out all sorts of tab stops in the text and then drawing boxes.

For working with examples and templates, Presents has an excellent template library facility. You can browse through templates until you find an appropriate one. Then you can apply the template to a slide or to a range of slides. Templates can also be applied to the master slide or to a particular slide's background.

For slide production, Australian distributor InfoMagic has teamed up with The Computer Slide Centre, and Presents includes a modem transfer utility that makes shipping slides for preparation simple and quick.

Presents' weakness is text handling. There's no facility for importing text — not even from Acta, the desk accessory outliner that's bundled with the package.

At a glance

PowerPoint
Supplier: Microsoft
Tel: (02) 452 0288
Price: $756
Requires: System 4.1 or later, 1Mbyte and two 800k drives or hard disk.
In short: An easy-to-use tool that makes very attractive presentations.

GRAPHICS

Slide making software shoot-out: a feature-by-feature comparison

Features	PowerPoint	Cricket Presents	ReadySetShow
Drawing tools			
Ovals	yes	yes	yes
Rectangles	yes	yes	yes
Rounded rectangles	yes	yes	yes
Lines	yes	yes	yes
Arcs	no	yes	no
Triangles	no	no	yes
Polygons	no	yes	no
Freehand	no	yes	no
Border	no	yes	no
Diamond	no	yes	yes
Rhomboid	no	yes	yes
Full colour	yes	yes	yes
Colour schemes	yes	no	no
Colourising	yes	yes	no
Alignment	no	yes	yes
Centring	no	yes	no
Grouping	no	yes	yes
Layering	yes	yes	yes
Templates	many	some	few
Graphing tools			
Types of graphs	none	8	5
Depth (3-D)	n/a	yes	shadows
Picture bar charts	n/a	no	yes
Exploding pies	n/a	no	yes
Text tools			
Free-form text	yes	no	no
Structured text	yes	yes	yes
Tables	no	yes	no
Decimal tabs	yes	yes	yes
Centred tabs	no	yes	yes
Justified tabs	no	no	yes
Right-aligned tabs	no	yes	yes
Tab leaders	no	no	yes
Leading	yes	yes	yes
Find/replace	yes	no	yes
Spelling checker	yes	no	yes
Glossaries	no	no	yes
Colour text	yes	yes	yes
Style sheets	yes	no	yes
Slide tools			
Title sorter	yes	yes	yes
Visual sorter	yes	yes	yes
Slide show	yes	yes	yes
Special effects	no	yes	yes
Master slide	yes	yes	yes
Date stamping	yes	yes	glossary
Time stamping	yes	yes	glossary
Output			
Handouts (slides per page)	2, 3, 6	2, 3, 4, 6	2, 4, 8
Notes pages	yes	yes	yes
Affiliated slide preparer	none	The Computer Slide Centre	none
Import/Export			
Text import	MORE, ThinkTank	none	ASCII, WriteNow, MacWrite, Word
Text export	none	none	none
Graphics import	PICT, PICT 2, EPSF, Paint	PICT, PICT 2, EPSF, Paint	PICT, PICT 2, EPSF, TIFF, RIFF

At a glance

Cricket Presents
Supplier: InfoMagic
Tel: (02) 975 1044
Price: $998
Requires: Apple System 4.2 or later, 1Mbyte and two 800k drives or hard disk.
In short: A powerful presentation tool with a strong emphasis on graphics. It has a template capability which makes mixing and matching graphics elements easy.
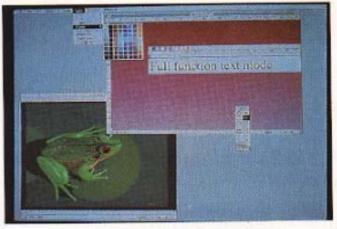
Presents includes a charting environment capable of producing several types of business graphs in full colour

Present's heirachical Colour menu, showing a grid of 64 colours

There's also no spelling checker, nor is there a find-and-replace mechanism. Another major flaw is the program's inability to export slides, graphics or text. If you want to use an output device that does not have a Chooser-level driver, you're out of luck.

A minor flaw is that the hierarchical Colour menu offers only the names of colours, and only 64 of them at that. Since the Mac II offers up to 16 million colours, it's hard to conceive of them all having names and even harder to conceive of being able to visualise a shade

ReadySetShow's interface gives the package power. Because of the array of features, it can be difficult to learn

ReadySetShow's desktop publishing background is useful when importing art from other programs

wealth of examples and the carefully co-ordinated colour schemes provided by Genigraphics make PowerPoint the best choice for making striking and useful slides with little effort, especially for non-artists.

2. Cricket Presents — A strong finisher. The powerful drawing environment is off-set by the less sophisticated text han-dling. The template library facility is ex-cellent, but the templates provided lack the pizzazz of the Genigraphics ex-amples. If you prefer the Cricket-style in-terface, if the lack of export capabilities isn't important to you, or if you need the better drawing environment, then you might want to choose Presents over PowerPoint. Experienced slide preparers and artists, who don't require the help of Genigraphics, will prefer Presents.

3. ReadySetShow — A contender. The features chart makes ReadySet-

ReadySetShow

ReadySetShow comes from the com-pany that produced Ready,Set,Go!, and the page-layout orientation shows. ReadySetShow's interface is very much like its sibling's, which gives it power. Of course, if you don't like the interface of one, as some people don't, you won't like the other.

ReadySetShow has a good full-fea-tured drawing environment that is almost the equal of Presents'. Its desktop-publishing background makes it espe-cially useful when importing art from other programs, offering the ability to scale and crop images. It can even automatically run text around graphic im-ages (although since the best slides are usually the simplest, this feature shouldn't be used frequently).

ReadySetShow also has an integrated charting feature similar to that of Presents. The charting abilities include exploding pie charts and the use of pic-tures in bar and column charts.

The text-handling capabilities of ReadySetShow are the best out of the three packages. You can import text from a variety of word processors, and the text-handling features are those of a

powerful desktop-publishing program. ReadySetShow is also the only program of the group that allows slides to be ex-ported as PICT files. This can be valu-able if you have a slide recorder that lacks a Chooser driver.

The major drawback of ReadySetShow is its complexity. Because of the array of features it offers, it can be difficult to learn. It also lacks strong examples to work from, so non-artists will have dif-ficulty creating attractive and effective slides. And there's no professional slide-preparation service allied with Letraset, which makes producing 35-millimetre slides more difficult and perhaps more expensive.

Conclusion

After reading the list of features and quirks of each of these three presenta-tion packages, you've probably already come to the conclusion that there is no clear winner. This three-way race is al-most a photo finish, and the five-way race including MORE II and Persuasion is likely to be equally close. Here is one opinion of the order of finish:

1. PowerPoint — A surprise winner. Looking at the features chart, handicap-pers might have picked PowerPoint to trail the field. The edge on the track was due to the influence of Microsoft's partner in slides, Genigraphics. The

Show look like the clear winner, but its dearth of strong example templates and its lack of a professional slide-prepara-tion service partner slow it down. Its power is also a drawback, as it is the most difficult of the three to learn (un-less you already know Ready,Set,Go!). Desktop publishers (particularly Ready,Set,Go! users) and artists might prefer ReadySetShow to the other programs.

Depending on your background and needs, the order of finish can be quite different for you. All three of these products are good, and all three should find a market. Based on looks at pre-release versions of MORE II and Per-suasion, both of them will be right in the race as well, and MORE II has a good chance to be the overall winner. The really good news is that with all this ex-cellent competition, all five products are likely to be made even better in future versions. Whichever one you choose, you'll end up with a winner.

END

Look to the stars

What on earth have computers to do with seeing stars? Far more today than the naked eye — a decidedly old-fashioned method of observation. From remote-control supercomputers to a micro and a 6in reflector, computers now dominate astronomy — and, as Guy Swarbrick describes, can even replace the observer.

Almost since their invention in the late 1940s, computers have been used by astronomers. Today, most areas of professional astronomy rely heavily on them and many, particularly those that deal with 'invisible' objects, such as infra-red or X-ray sources, could not function seriously without them.

Gone are the days when the professional astronomer would wander out to the observatory, crank open the doors on the dome, point the telescope at the sky and stick his eye at the bottom end — though, to be fair, such techniques were ousted for most work over a hundred years ago with the advent of photography.

Astronomy is a big-budget academic science which, in America at least, enjoys considerable (although inevitably inadequate) financial support. It has traditionally had the largest, fastest supercomputers available to it at universities and government research establishments. This has led, to a certain extent, to astronomers being 'spoiled' in terms of computing power, and has resulted in expensive mainframe time being used for tasks which could easily be accomplished with a PC.

It would be wrong to think that the micro revolution has passed the astronomical world by; computers are used extensively and the trend is growing, but it must be said that professional astronomers have been slow to see the implications of the technologies. In some

aspects, as so often has been the case in astronomical history, the amateur has led the way.

Just as photography brought about a revolution, so has the arrival of the computer. Now, an astronomer is more likely to sit in a control room next to the observatory, type in the co-ordinates of the object he wants to observe (or even its name) and watch the whole thing on video. Of course, there is no need for him to be there at all, as the session can be pre-programmed and recorded either on video tape or as a series of digital images.

This is being done at the Grove Creek Observatory (60km from Bathurst) for Solar observing — a video camera and recorder are connected to the 14in telescope and the results are viewed later at high speed.

Imaging

For a number of reasons, photography has dominated astronomy for over a hundred years. Firstly, a photographic emulsion is capable of resolving far more information than the human eye. Left to track a star, a photographic plate gathers photons, for several hours if necessary, to record even the faintest object.

Secondly, and perhaps more importantly, a photograph is a permanent and objective recording of an event. (Astronomy is, in reality, about events,

not objects. Although most of the universe in which we live appears, on the large scale, to be unchanging, it is the changes which do occur which tell us the most about it.) An accurate representation of these events and their effects is far more useful than a subjective observer's notes and sketches.

Photography will remain with us for a long time, despite the advent of solid-state alternatives such as the charge coupled device (CCD). CCDs (also known as silicon cameras) are arrays of light-sensitive cells which were originally developed for video cameras. They work by converting light into electricity and are extremely sensitive, so observations which would have been made photographically can be made much faster.

But there are problems. For astronomical work, they have to be cooled with liquid nitrogen, both for increased sensitivity and to avoid loss of data due to leaking. The leaking at room temperature is not a problem in video cameras where a dynamic picture is being captured on tape 50 times a second, but it is critical in 20-minute astronomical exposures.

CCDs are also highly expensive and, for the moment, resolution is fairly low (385 by 578 is not atypical, though larger, up to 2048 by 2048, devices are at the experimental stage). Photographic film, on the other hand, has a relatively high resolution, works at normal

temperatures and is cheap. Whether you gathered your data from a CCD or from a conventional photograph which has been digitised, though, it is not easy to work with an array of brightness values.

As with all image processing, the first and most fundamental step is to produce an image histogram of the digitised image. Despite being extremely simple to produce and being a graph of the brightness levels of each pixel in the image, an image histogram is the starting point of most enhancement techniques.

For example, if a particular image histogram shows the majority of values confined to a relatively small range of intensities, the data can be spread over the whole range of displayable intensities, increasing the difference between values and so enhancing contrast.

Other techniques can be used to compensate for faults in optical systems, enhance images of planetary detail, remove film grain, scratches and other defects caused in processing, or adjust colour balance to compensate for film and processing characteristics.

False colours

The area of image processing which attracts the most public attention is probably the production of false colour images. Much confusion can arise as the public is often shown a multicoloured picture of an object and given no explanation of what the colours represent.

False colour imaging involves taking a digitised image of an object and using different, usually bright and primary, colours to show different levels of detail. The most common use of this is to show radio, X-ray or other non-visible emissions with, say, white as the area where emissions are at their most intense, going down through yellow, green, blue and so on. Although such images can be recorded using film or sensors tuned to the wavelength of the radiation involved, they obviously cannot be 'seen' conventionally.

Much confusion arose in 1986 when false colour images of Comet Halley were shown on television news. The general public was not used to seeing these brightly coloured images, particularly of visible objects.

To add to the confusion, Halley had been hailed for months as a grey-brown 'dirty snowball'. The pictures of Halley, which showed different levels of brightness in false colour, led many people to suspect that either the Russian or European Halley Missions had spray-painted the comet to make it look pretty, or that astronomers were quite mad.

In fact, false colour imaging is invaluable for spotting patterns in highly detailed pictures. The human eye can detect very few shades of grey, possibly less than 300 and, even though the image histogram may show a detailed, high-contrast picture, the human eye may be unable to distinguish much of it. False colour imaging highlights areas of interest — such as the head of a comet or an emission jet from the heart of a galaxy. The alternatives for the non-visible areas are either metres of raw numerical output or contour diagrams, which can be as hard to interpret as the original data.
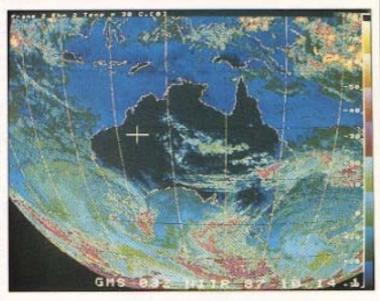
Contour diagrams have their uses, however, and constitute another area where computers are used heavily. The techniques involved are similar to false colour images with the colours being replaced by lines joining areas of similar intensity of emission or brightness, in much the same way as a conventional contour map represents height or a weather map shows atmospheric pressure.

Digital techniques also allow the production and enhancement of true colour images by combining three monochrome pictures taken through red, green and blue filters.

False colour imaging, referred to above, is actually a combination of false and true colour imaging. An obvious example of this is the infra-red satellite pictures so beloved of weather forecasters.

Here, a true colour image is prepared of the required area using a visible light sensor. Then, a second (or more accurately, fourth) scan is taken, this time using an infra-red camera. A false colour image is prepared highlighting the difference between the land and the clouds, usually with the clouds in white.

Image processing is not always concerned with merely enhancements, but is often used to create one. The pictures which flashed across the world from the Viking missions to Mars and from Voyager's flights past the outer planets

Satellite pictures are a common example of false-colour imaging techniques. Data for the production of satellite and radar images can be downloaded from the Bureau of Meteorology. Contact Mr R Del Beato at the Services Policy Branch on tel: (03) 669 4213 for details

have, more often than not, been composite pictures produced in the backrooms at the Jet Propulsion Laboratory in Pasadena, California, by image processing teams.

The digitised images sent back to Earth are, because of the low resolution of the cameras, small fragments of the final image, combined on their return to produce spectacular 'wide-angle' mosaics.

Perhaps the most exciting use of imaging over the last few years has been in mapping the surfaces of planets and even other stars. Pluto and, to a lesser extent, its tiny moon Charon have been mapped using a subtraction technique from images taken as the two objects eclipse each other. The technique has also been used, with limited success, to map 'sun-spots' on stars.

Computer control

Another area which is quite fundamental to modern astronomy is the use of computers as control devices for telescopes. Indeed, in some ways it can almost be said to be fundamental to computing, since the programming language Forth — which is still a firm favourite for real-time control systems — was developed for controlling radio telescopes.

Computer-controlled drive mechanisms can move telescopes (both optical and, of course, radio and other less 'conventional' types) with an accuracy far in excess of purely mechanical methods.

The increased accuracy is achieved mainly through the drive which tracks the

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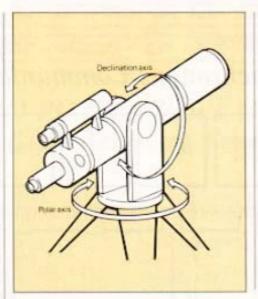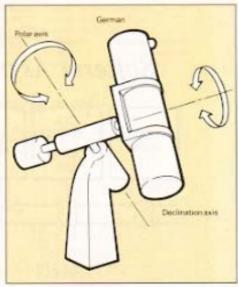
star, being simpler and more precise and, in particular, being able to compensate for expansions in the instrument due to temperature changes and other anomalies which would have upset a purely mechanical system.

Moving a telescope, of course, is a problem not simply of pointing the telescope at an object, but of holding it there as the Earth rotates. Due to the tilting of the Earth's axis, tracking a 'fixed' star involves considerable telescope movement, especially for objects a large distance from the celestial pole.

The conventional way around this problem has been to use a telescope with an equatorial mount. A conventional tripod has two axes, altitude and azimuth (or up/down and left/right), and to track a star, constant adjustments must be made in both directions. An equatorial mount has one of its axes aligned with the celestial pole. This arrangement means that a star can be tracked with a more simple, circular motion in one axis only.

The problem with an equatorial mount is that it puts the telescope off centre and makes the setup unstable. With large telescopes this means you need a huge counterbalance. This in turn in-

Alt-azimuth mounts, like those on a normal tripod, require adjustment in two directions to track a star. The equatorial mount needs to be driven around just one axis but is heavier and more complex. Computer control allows the far cheaper alt-azimuth design to be used for the first time on large instruments

creases the mass of the apparatus and, therefore, the power of the motors needed to drive it.

Computer control has made this largely irrelevant, as the computer can comfor-

tably adjust the telescope in both axes on a much lighter and, more importantly, far cheaper alt-azimuth mount. The Advanced Technology Telescope at Siding Springs, Coonabarabran, is another alt-

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ASTRONOMY

azimuth design — indeed, rather than turn the telescope on an equatorial mount, the designers have opted to rotate the entire building!

Computer control also allows remote control of an instrument. It can be far more cost effective to have an observer at the Royal Greenwich Observatory in Herstmonceux Castle in Sussex control the United Kingdom Infra Red Telescope (UKIRT) in Hawaii or the Anglo-Australian Telescope.

Active telescopes take computer control one step further by replacing the observer altogether. Observing plans can be drawn up and uploaded to a telescope's control computer, which then takes care of everything from opening the dome doors to tracking and recording objects and documenting the observations.

Active telescopes are particularly useful for the boring but necessary astronomical activities like star catalogue compilation, where at least a year's observations are required. They are also useful in more interesting but equally painstaking jobs such as comet hunting, where human error can play a major part. (Many comets have been spotted and recorded by one person, but overlooked, only to be 'discovered' by another person a few days later. This can be particularly damaging to a comet hunter's ego as comets are named after their discoverer.)

Multiple-mirror telescopes

One recent spin-off of this is in the design and construction of really large telescopes. The problem with conventional construction techniques is that to gather more light you need, in the case of a reflecting telescope, a bigger mirror. Not only does the cost of mirrors increase exponentially with size, but really large mirrors also have a tendency to collapse under their own weight. Mirrors can be made really thin, but then they are more susceptible to vibration and changes in size due to temperature.

The Keck telescope, which the University of California and the California Institute of Technology (Caltech) hope to

Computers and the amateur

Unlike most of the other sciences, amateurs still have an invaluable role to play in research. Often this is in observing objects whose nature is known and, therefore, merit little professional interest, but whose study can lead to interesting discoveries.

Amateur contributions may even increase over the next few years as most, if not all, of the new techniques used by professionals can be used by amateurs. There is no reason (except possibly the cost) why you should not hook up your micro to control the 6in reflector in your back garden or process digitised images.

With literally everything to look at (all 'Earth sciences', geography, geology and so on are, in a sense, just branches of astronomy which specialise in the structure of our own planet), there is a lot of useful work which just cannot be justified in terms of big telescope time. In particular, the study of variable stars, about which much is still unknown, can provide an amateur with hours of interesting and useful work.

Jack Ells, admittedly a somewhat sophisticated amateur, has a fully automated telescope with stepper motors controlled by a micro and a digital photometer at the focus. It can take measurements and record them onto disk at the rate of 30 an hour, and the software enables observations to be made through, and can compensate for, moderate amounts of cloud cover. This raw data is later reduced on the same computer and has been found to be up to 10 times more accurate than the human eye, in particular in subjective areas such as colouration.

Most Japanese and American

amateur telescopes of reasonable size now come with computer control of some description, if not as standard at least as an option. In their most basic form, computer 'control' devices merely sense the position of the telescope, but can't actually move it. They will allow you to choose an object from their internal database, however, and direct you as you manually position the telescope. More advanced systems manoeuvre the telescope as well.

Many amateurs build their own control system and their own telescopes — these can be even more sophisticated. Indeed, the first active telescopes were amateur instruments.

As far as the engineering is concerned, it is certainly no more complicated (or less precise) than the construction of a telescope and the programming is relatively simple. The result can be to rekindle an interest in the subject or, perhaps, to add a new lease of life to a telescope with a simple, alt-azimuth mount.

Several members of the BAA (NSW Branch) are currently involved with automating a 10in reflecting telescope — the telescope is on a Dosonian mount (a form of alt-azimuth mount that lends itself to computer control) and will be capable of being driven as either an equatorial or alt-azimuth.

Image processing is another area where amateurs can make real progress. People often assume that image processing can only be usefully done on a machine with a high specification display system like the Apple Macintosh II or the Commodore Amiga. In fact, for the most part, the actual display is irrelevant.

Any picture, of any resolution and with

any number of colours, can be stored and manipulated on any computer. The only restriction is the amount of memory available. There is no reason why six-colour, false colour images of a 256-grey scale original shouldn't be produced on an Atari ST or a PC with EGA. As in professional astronomy, computers needn't only be used for the expensive but impressive side of astronomy. Many people use database systems to record observations, and one well known amateur uses a spreadsheet to record and analyse observations of variable stars.
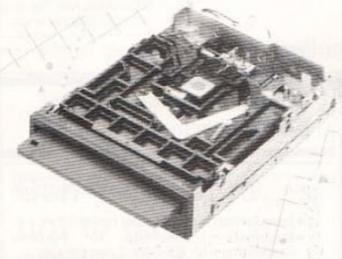
Several Australian amateur astronomers are using small personal computers to record, analyse, and display the results of photometric observations (a photometer is a device for measuring the brightness of objects). These readings are used for variable and flare star recording, minor planet (asteroid) rotation data, and occultation timing (where one object blocks the light from another). Some of these events require long periods of observation (one 15 second event in a 12 hour observation period) and are ideally suited to computerised data collection.

Australian amateur astronomers have access to several 'dial-in' information sources. These include the The Black Hole — the official bulletin board of the British Astronomical Association (NSW Branch), which has 'online' programs available for astronomical calculations; several databases of stellar information; all the current International Astronomical Union circulars and Solar reports (obtained directly from the USA); and the Astronomical Data Service of the Astronomical Society of NSW and Viatel.

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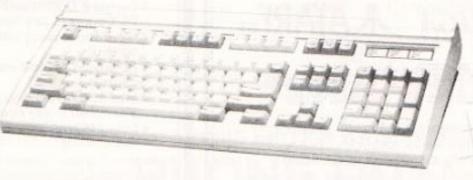
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have in operation at the top of the Mauna Kea volcano in Hawaii in 1990, will have a primary mirror 10 metres in diameter, twice the size of the famous '200-inch' five-metre Hale telescope at Mount Palomar in California. A conventional mirror of this size, as thick as the Hale instrument, would be 16 times more flexible.

This is achieved using not one mirror, but an array of 36 hexagonal mirrors, each uniquely shaped to form part of the hyperboloid which defines the surface of the entire mirror. The result is a mirror with four times the area of the Hale telescope but the same mass.

The first problem with such an instrument is to produce the hexagonal sections to the correct shape. Most of the grinding is done conventionally, but the finish is produced using a computer-controlled polishing machine with all the segments mounted on their supports.

The problem then is of alignment. Gravity still works on the segments of the mirror and, as it can't bend them, it tends to push them out of alignment so the mounts for each individual segment are active. Sensors around the edge of each segment detect movement and

counteract it by a device known as a 'whiffletree'. This reduces the movement from 1700 nanometres without whiffletree support to eight nanometres (1/8 thousand-millionth of a metre).

With its active mirrors, computer-controlled alt-azimuth mounts and sophisticated imaging systems, the Keck telescope would have been impossible to build 10 years ago.

Perhaps the ultimate computer-controlled telescope is the long baseline radio interferometer. Using computers to combine the data can effectively turn twenty-seven 26-metre radio telescopes spread over a distance of 20km (such as the VLA — Very Large Array — at Socorro, New Mexico) into one 20km diameter dish.

In the Southern Hemisphere we now have the Australia Telescope — the most powerful radio-telescope in this half of the world with six 22-metre dishes at Culgoora capable of being linked to another 22-metre dish at Coonabarabran and the 64-metre dish at Parkes. This forms an array with an effective baseline of 320km. The resolving power (ability to see detail) of this 'Long Baseline Array' is equivalent to being able to read the telephone directory at a distance of 10km!

Conclusion

In addition to the glamorous techniques of multi-million dollar telescope control and image processing, computers are used by astronomers, probably more than anything else, for simple number crunching.

From computing the elements of the orbit of Comet Halley from historical data on an Apple II to developing models for the formation and evaluation of stars, planets and the universe itself, computers have helped move astronomy further forward in the last 30 years than it had managed in the last 300.

Some idea of the impact computers have made in the field of astronomy may be gained from the fact that the calculation of planetary motions takes only a few seconds on a personal computer — but Johannes Kepler (who formulated the principles) took 10 years to calculate the orbit of one planet in 1596.
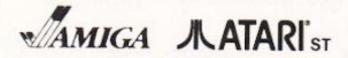
APC would like to thank Ken Thompson for assistance in producing this article.

COMMUNICATIONS

Australia's oldest CBBS

Peter Jetson describes the history of Australia's oldest continuously-running bulletin board, while Steve Withers catches up on the latest system news and updates.

In Easter 1982, Micom created history by bringing online Australia's first computer bulletin board system, using a Z80 CP/M computer running Ward Christensen and Randy Suess' CBBS software. It was operated by myself, Peter Jetson, on behalf of The Microcomputer Club of Melbourne (Micom), which also happens to be the oldest computer club in the country.
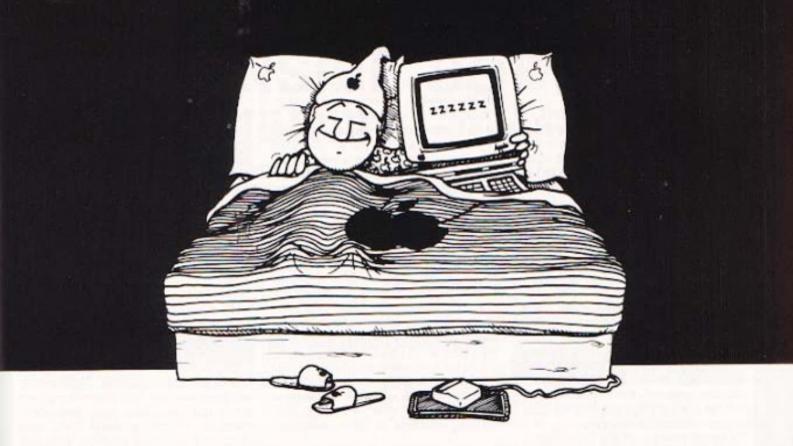
The system was quite successful, but as the computer and the phone line were only borrowed for the Easter period, Australia's first CBBS had to be turned off after just a few days.

By October 1982, we managed to cobble together a system of our own. And what a system — one second-hand 8in disk drive (with 240k of storage!), a modified Big-Board CP/M computer, two pieces of aluminium bent into an L shape for a chassis, a junked ex-Telecom 300 baud modem, and assorted sticky-tape and string holding the whole system together. We managed to create this mess for a mere $600, and it even worked.

After a while, though, the disk drive started to cause problems. The drive had been thrown out by its previous owners, and it soon became apparent why. A new replacement cost $480, almost doubling the price of the system. But, with a good drive, we were able to run double-sided and double-density,

Then and now: the Sendata acoustic coupler from the early 1980s pales by comparison with today's NetComm Trailblazer

Page 350 APC 100th Issue

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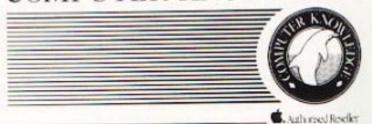
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When we first started the CBBS, I could count the number of users on one hand, and I knew them all personally. But soon the system became so busy that the phone was permanently engaged, and even I couldn't get on for maintenance.

The newness of the medium and the lack of other similar systems expanded Micom's membership immensely, and flush with funds, we decided to upgrade the hardware to S100 and multi-user, running Z80 CPU cards under the TurboDOS multi-processor multi-user operating system, in a proper box and with a hard disk.

It took a few months to re-write the bulletin board software with all the necessary file and record locks to support multi-user operation, but it was time well spent because the system and the club went from strength to strength.

But times change. In the beginning, I knew all the users and the sysops of the other two or three bulletin boards. Then, modems became cheaper, computers became mass-market consumer items, and the face of our hobby began to change.

Many people began to develop BBS software, and many, many more systems were brought online. The IBM PC and its many clones became the standard in computing, and the 'techie' types — the grass roots computer users — began to dwindle in numbers, while a new breed began to take over — the 'users'. Computer clubs like Micom weren't what these people wanted, so our membership and BBS 'community' began to diminish.

In an effort to attract new members and provide a better forum for our current members, we decided to again upgrade our BBS system, and join the 'New Wave', a world-wide BBS network.

Our new system runs on a typical Taiwanese PC clone, running MS-DOS 3.21, with a 40Mbyte voice-coil hard disk and a NetComm Automodem 1234 running 300, 1200, 1200/75 and 2400 baud. Except for the PC, that's progress (PC-bashing is in vogue at the moment).

The software we selected was the increasingly popular Opus. As an introduction to this system, let me quote from the user's manual: 'Opus is a sophisticated BBS (bulletin board system) which supports a broad array of services for the transfer of Electronic Mail and the exchange of Public Domain software'. It is, in short, a truly integrated BBS which brings state-of-the-art information and data exchange capabilities to each user.

The powerful functions of Opus are further enhanced by a menu-driven user interface which is both fast and friendly.

In its traditional role, Opus supports a large number of file transfer capabilities, specialty file areas, file-related services and multiple file exchange protocols. However, the real power of Opus lies in its E-mail capabilities. These services allow a user to link to a variety of other bulletin boards on a national or world-wide basis. E-mail of virtually any variety can be accommodated. Such services as private/public conferencing, multi-BBS discussions, EchoMail and mail file transfer are all available through Opus.

As a user of an Opus system, you may want to be involved in the E-mail aspect of 'BBSing'. Together, the many Opus systems form a network (a Matrix) which, when combined with other participating systems in other networks,

> '. . . a call to a single bulletin board system no longer connects you just to the users of that system — it connects you to the world.'

result in a national 'electronic convention' which takes place daily.

So, in stark contrast to early 'local' bulletin board systems, all Opus (and compatible BBS programs) can be connected together to become one huge network. Facilities exist for multi-system conferences, where messages left on any of the participating systems are transparently forwarded to all other systems sharing the same conference. Network architecture means that it may take a day or two to propagate to all corners of the network, but who cares — this is state-of-the-art, and fun to boot.

Besides shared conferences, we can also have conferences local to our own board, and we currently run two of these. One is for discussions within Micom, and the other is a special area to collect 'comments' left when users log-off, along with queries to the sysop.

So there you have it — a call to a single bulletin board system no longer connects you just to the users of that system — it connects you to the world.

System news

One of the problems with BBSs is that

you occasionally come across an individual who is a pain in the neck. In the days of standalone boards, an operator could simply ban someone for repeatedly placing offensive, inappropriate or just plain unwelcome messages. The advent of FidoNet and similar networks means that such action is no longer sufficient, as messages are passed from one system to another. Network protocols (in the human, rather than digital sense) insist that messages may not be filtered before they are passed on, so what is to be done?

Well, it seems that one sysop had had enough of the messages generated by a particular person and wrote a program (called KILLRDOG) to take care of the problem. It works with Opus, and does its job after network messages are unpacked. Before they are dropped into the different subject areas, all messages from the nominated user(s) are removed. It's a neat solution that eliminates the problem while staying within the rules of the network.

This month's listings were compiled with help from Mark Burrows, Anthony Horan, Trevor Hopps and Larry Lewis.

New systems

NSW

Disaster Area (02) 918 8320. MV. Matt Dalton. V21 V22. FidoNet 714/905.
Food For Thought (02) 683 6093. P. Steve Thompson. V21, V22, V22bis, V23.
Helping Hand (02) 872 3571. MV. Dave Hatch. FidoNet 711/807. V22, V22bis, Trailblazer.
RTI's Pinkboard (02) 810 8267. MV. Laurence Singer. V21, V22, V22bis, V23.
Sydney Information Xchange (02) 519 6681. MV. Lawrence Gould. V22, V22bis.
Tech Exchange (02) 712 2282. MV. Chris Moran. V21, V22, V22bis, V23.
Macarthur BBS (046) 28 1499. P. Peter Degotardi. V21, V22, V22bis, V23.

Vic

Fruit Shop (03) 859 1245. MV. 'Con Nection'. 4.30pm-9.30am weekdays, 24 hours weekends. V21, V22, V22bis, V23.
Fantasy Mildura (050) 24 2826. P. 24 hours weekends only. V21 only.

Qld

Galaxy GateWay Computer (07) 207

8900. MV. James Collins. V21, V22, V22bis, V23. FidoNet 640/230.
Transcendental Connection (07) 281 9418. MV. Kenneth Page. V21, V22, V22bis, V23.
Teletex Connection (076) 34 6686. MV. 9am-10.30pm daily. V23 videotex only. Visitor ID: 1234567890.

NT

Diversion (089) 85 3040. M. Trevor Hopps. 24 hours daily. V21, V22 (Bit Blitzer).

WA

Atari Apex (09) 451 7288. MV. Andrew Waite. V21, V22.
Gamma Istari (09) 493 1534. P. Richard Dale V21, V22, V22bis, V23, Bell 103, 212. FidoNet 692/626.
Gas Station (091) 82 2469. P. Don Hill. 5pm-6.30am weekdays, 24 hours weekends. V21, V22, V22bis, V23. FidoNet 692/624.

Updates

NSW

Airlock Hermitage Offline.
Australian Pick Users (02) 631 8603. MV. Kurt Johannessen. V21, V22, V22bis, V23. FidoNet 713/610.
Caamora Systems Possibly offline.
CommLink BBS Offline.
Commodore C-64 (02) 664 2334. MV. Graham Lee. V21, V22, V23. FidoNet 712/629.
Cursor Contact Possibly offline.
First Nice MIDILine Offline.
Kiwi Konektion Offline.
Micro Mart C Users Offline.
Phantom Connection (02) 399 7716. M. Bob James. V21, V22, V23. FidoNet 712/307.
Playground BeeBS (02) 534 6944. MV. Brett Selwood. V21, V22, V22bis, V23, Trailblazer. FidoNet 712/504.
SBA (02) 411 1850. MV. Bob Wilson. V22, V22bis, Trailblazer. FidoNet 711/406.
Software Tools (02) 449 9477. MV. Bill Bolton. V22bis, Trailblazer. FidoNet 711/403.
Square One BBS (02) 552 2582. P. Ted Harrison. V21, V22, V22bis, V23, Trailblazer. FidoNet 712/705. Formerly known as Silicon City.
The Black Hole (02) 819 6971. MV. Ken Thompson. V21, V22, V22bis, V23, Bell 103, 212.
Triops (063) 62 9715. P. 'Pdisk'. 9pm-6pm daily. V21, V22, V23.
Albury and Wodonga Offline.

New Frontiers CBCS (046) 25 6954. Howard Pew. V21, V22, V22bis, V23. FidoNet 713/613.

Vic

AIM (03) 592 3338. MV. David Hellwege. V22, V22bis. FidoNet 632/350.
Big Tedd's (03) 509 6067. MV. Rob Bates. V21, V22, V22bis, V23. FidoNet 632/302.
Cad Phone (03) 890 0091. MV. Stuart Szabo. V21, V22, V23. FidoNet 633/367.
Eastwood (03) 870 4623. MV. Mick Stock. V22, V22bis, V23. FidoNet 632/343.
Infotext (03) 741 9055. V23 videotex only. Previously known as Videotex/4000.
Super Dimensional Offline.
The Software Bank (03) 820 1632. MV. Simon Walsh. V21, V22, V22bis, V23, B103, B212. FidoNet 632/301.
The Witche's Brew (03) 718 2198. P. Erika Matlen. V21, V22, V22bis, V23, B103, B212. FidoNet 633/370.
Excalibur (057) 83 1040. P. Maurice Copeland. 6pm-8am weekdays, 24 hours weekends. V21, V22, V22bis, V23.

Qld

AMPAK (07) 263 7070. M. Brian Wendt and John Bews. V21, V22, V22bis, V23, Bell 103, 212. FidoNet 640/205. Also Packet Radio.
Binary Barrels (07) 862 1860. P. Viv Brunner. V21, V22, V22bis, V23, Bell 103, 212. FidoNet 640/210. Formerly known as Turbolink Australia.
Commodore Computer Users Group Queensland (07) 344 1833. MV. Greg Shea. V21, V22, V22bis, V23. FidoNet 640/304.
JabberWOCky (07) 808 5526. MV. David Drummond. V21, V22, V23. FidoNet 640/305. Formerly known as Tommorrowland.
Swiss Pavilion BBS Offline.

SA

Burning Bush Offline.
The Hackers Retreat (08) 266 2408. MV. John Waye. V21, V22, V22bis, V23. FidoNet 681/857.
Olympic Offline.

WA

Amiga Mouse Offline.
Nemo 3 Offline.
Perth PC Users BBS Offline.
Treasure Island (09) 271 0471. MV. Gloria Platt. V21, V22, V22bis, V23.

END

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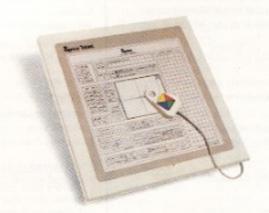
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C how they run

*All at sea with C? Our panel of book reviewers guides
you through books both for the novice and the expert.*

Numerical Recipes in C
Authors: William H Press, Brian P
  Flannery, Saul A Teukolsky and Wil-
  liamT Vetterling
Publisher: Cambridge University
  Press
ISBN: 0-521-35465-X
Price: $85.00

Broadly speaking, C is a block-struc-
tured language. This means that it bears
some similarities to Algol and Pascal. In
particular, it allows the compartmen-
talisation of both code and data. A C
program, therefore, consists of a collec-
tion of functions, each of which is an in-
dependent program with its own local
variables.

The independent nature of a C function
means that it is very easy to build up
libraries of functions which can be simply
slotted into any larger application
program.

All variables are local to the functions —
the programmer simply needs to ensure
that the right arguments are passed to the
function. It is the existence of libraries of
C functions which is one of the reasons
why C is such a powerful language.
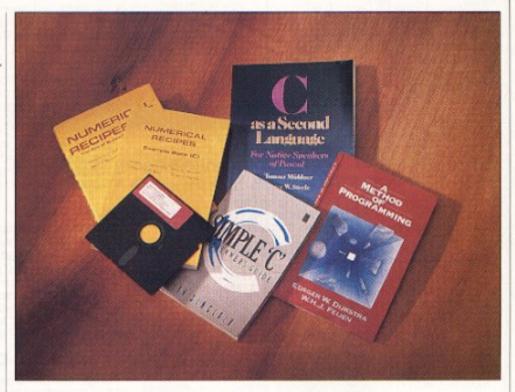
A library of over 200 C functions is
provided by the authors of this book,
'Numerical Recipes in C — The Art of
Scientific Computing'. As the subtitle
states, all these functions are for scien-
tific computing.

The book contains a collection of real
programming nasties, including such
things as Gaussian Quadratures, Bessel
curves and multi-dimensional integrals.

This is a veritable goldmine of
programming resources which will pay
immediate dividends to anyone who is
involved in writing C programs with a
high mathematical content.

The real value of this book is not just
that it contains the printed code for over
200 complex mathematical functions, but
it also explains in detail the mathematics
behind each function.

Admittedly, some of the maths is very
difficult. However, the supporting text en-
sures that you know what the routine
does plus why and when it should be
used.

My conclusion about this book is simp-
ly that if you are going to write a program
which involves complex numerical
operations, then you will probably find it
invaluable.

It is well-written, well-printed and well-
produced, and if you want the programs
on disk, the publisher can supply them
for a nominal extra charge.
N Hampshire

C as a Second Language
Authors: Tomasz Müldner and Peter
  W Steele
Publisher: Addison-Wesley
ISBN: 0-201-19210-1
Price: $32.95

Any programmer who still hasn't learned
C and wishes to retain even the smallest
portion of their 'street cred' has, at least,
a wide choice of possible methods —
from videos to residential courses.

Those, on the other hand, who prefer a
more conventional approach still have to
choose from a daunting array of different
C tutorial and reference books.

If your training is in Pascal, 'C as a
Second Language' would undoubtedly
stand out from the crowd on a bookshelf.
My advice, however, is to leave it there.

It's not that there's anything particularly
wrong with this book per se; indeed, it
deals with all the different aspects of C
in a readable, thorough manner (at 560
pages it's *very* thorough). The problem is
that it doesn't *teach* you C.

The book is divided up logically into dif-
ferent subjects, all of which are dis-
cussed in the same manner. First comes
a brief description of the subject, fol-
lowed by the way Pascal implements it.
The Pascal and C methods are com-
pared and then the C implementation is
expanded on. Finally, a short glossary
and some exercises are provided. This
is rounded off with brief discussions of C
on the PC, Mac and under Unix and the
usual plethora of appendices.

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The main problem with this 'phrase book' approach is that it teaches you how to make a C compiler understand you, but not how to express yourself properly in the language.

However, the book is not without its uses. If you are a Pascal programmer who occasionally has to maintain other people's C code or you are quite happy to write Pascal programs in C code, then this might be the book for you. Perhaps a better title would have been 'C for Tourists'.

S Waters

Simple 'C', A Beginners Guide

Author: Ian Sinclair
Publisher: David Fulton
ISBN: 1-85346-057-5
Price: $35.85

Like many programmers, my first introduction to C was through a book by Kernigan and Ritchie, the great pioneers of C programming. In the decade since this classic was first published, there have been countless books whose aim has been to teach C programming. One of the latest of this genre comes from that most prolific writer of computer books, Ian Sinclair.

This, his 99th title, is modestly called 'Simple 'C', A Beginners Guide' which aptly describes this 180-page volume. But, it is not a *total* beginners' guide as it is assumed the reader has some knowledge of programming and can write reasonable Basic.

The author starts with a broad introduction to the concepts embodied within C which have made it such an important language. Concepts like modularity and portability are covered, and Sinclair shows how it compares with such languages as Basic and Pascal.

From this introduction the reader is led through the structure of a simple C program and introduced to C functions and data types. At this stage the author takes the practical and laudable decision that the best way to learn programming is to program. The low-priced Zortech C compiler running on an Amstrad PC is used for all examples. The rest of the book covers all the major aspects of C programming. Included in the text are plenty of examples and I think that any reader who works through this book should become quite competent in C.

However, it must be said that C is not a language which is easy to learn. I have encountered many a professional C programmer who has confessed to be still learning even after five or six years' experience. C is a way of thinking, not just a collection of programming commands.

The text is well-written; if I were learning C again for the first time I am sure I would find this book useful. Unfortunately, however, the author has been very badly let down by his publisher.

The book is ordinary paper-back size and printed on a thick newsprint paper. This type of paper makes the print look awful and the typesetting as if it has been done by a trainee.

If you try and hold the book open to type in an example you invariably end up cracking its spine. I suspect that the pages would start falling out by the time any reader got three-quarters of the way through. In fact, as a self-teaching book the publishers have ruined it, and at $35.85 they are in my opinion charging far too much.

N Hampshire

General

A Method of Programming

Authors: Edsger W Dijkstra and WHJ Feijen
Publisher: Addison-Wesley
ISBN: 0-201-17536-3
Price: $36.95

A book for the purist at heart. All you programmers who think that the rules and definitions of programming are becoming too vague can now clap your hands with glee; this book has been written specifically for you. The authors felt it was 'necessary to reassess methods for program design and development' and have presented a text 'in which the correctness of programs is inherent in the design process'.

This book is not for the faint-hearted and definitely not for the novice programmer. Plunging into this unprepared could very well stop you in your programming tracks forever.
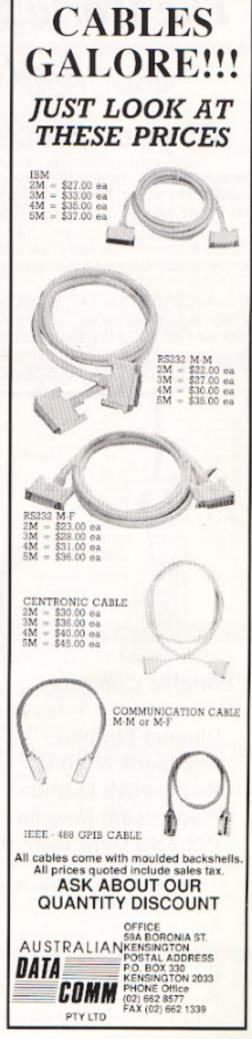
Divided into two parts, the text consists of lectures in Part 0 (computation as a change of state, the maximum monotone subsequence and co-ordinate transformation), followed by instructions in Part 1. The lectures introduce and unfold the subject, while the instructions show the desired methods to be used and also contain examples and exercises.

Exercises can be of the form 'Verify the annotation in this program, and formulate the termination argument' or 'Determine why 2K + 1 is not a syntactically correct integer expression'.

'A Method of Programming' is to be opened at your extreme discretion. You have been warned!

L Kyle

Benchmarks revised

APC, along with Standards Australia, have developed a new industry-standard method of testing computer performance. Geoff Ebbs and Mark Evans look at the tests making up the low-level section of our benchtest suite. Reference should be made to the benchmarks wall chart accompanying this issue as you read this article.

The process of developing a standard method of testing disparate computers is dominated by two conflicting considerations. The same tests must be carried out over a wide range of machines to ensure that the rating is meaningfully related from one machine to the other. Also, the tests should be as thorough as possible, testing the functions of the machine at a variety of levels.

However, these two needs work against each other and the following two examples illustrate this. Testing the performance of the peripheral devices would ideally be for the level of the hardware, the BIOS of the computer, the operating system and applications. When considering disk speed, this would involve writing directly to the disk controller, using the operating system to find specific locations on the disk, and finally, using the operating system's filing functions. The low-level test is not even manageable in the case of disk controllers such as the Small Computer Standard Interface, which resists being bypassed. Video output is similarly complicated.

After some discussion, we decided the best compromise was to develop a set of tests that can be performed in a highly portable language, which will operate independently of the operating system and emulate the behaviour of a range of typical applications.

Rather than aiming to develop the tests in a language that would behave identically on all processors, we tried to eliminate the variations introduced by different implementations of a program. Instead of recording the time taken to run a program performing a particular function, we recorded the difference in time between two virtually identical routines — one which performs the call to the hardware and one which does not.

For example, our routine to test sequential disk access opens a file and appends a certain number of records. The test is performed by starting the timer, opening the file and looping through the designated number of appends. The time taken is recorded, then exactly the same process is performed with an assignment statement replacing the disk write. In this manner, the time taken to perform the Basic code is removed and we are left with the time taken to perform only the one write statement a given number of times.

This double-loop method is credited to the British Standards Institute and the UK Personal Computer World magazine. We have improved on their tests by using C to perform the CPU and memory tests, as we felt Basic was too slow. Even using the double-loop method, we would really be testing the efficiency of a particular Basic's PEEK or POKE statement.

The other feature of our low-level tests that deserves explanation is the clock calibration function. This finds the number of iterations required for a stable result when timing a very fast loop, ie, one containing no instructions.

It works by timing the loop and comparing the results. If they vary by more than five per cent, the number of times the loop is performed is doubled. 10 tests must be performed before the number passes inspection. The number of loops required is mainly a function of the clock resolution. Timings of less than 10 milliseconds vary widely because the values returned by the clock are not accurate. Consequently, very slow computers will need to perform smaller numbers of loops to achieve stable results.

Computers' stability varied widely. Some of the faster computers settled down after a small number of iterations. The Skai 386, which is designed to military specifications, and the President 386 are examples of this. Because they are fast and perform only a small number of results, we introduced a multiplier for use on those occasions where a larger number is necessary.

Some machines return clock values that are not representative of real time. We have accounted for this by performing one test that compares the time returned by the Basic program to the time recorded by the tester on a stopwatch. To avoid mistakes made by the tester in entering the time recorded on the stopwatch, this process is repeated until two consecutive results give similar timings. If no similar timings are found then five results are averaged.

Of the machines tested, only the Amstrad returned false timings. It seemed to operate on a clock running three times slower than every stopwatch we put against it. It must account for this in its own time functions, because it ac-

curately returns the time of day. We tested four different hardware functions: Disk, Video, Memory and CPU.

Disk test

Ideally, a disk benchmark gives an accurate timing of the disk speed, and it may be combined with other hardware results to give an indication of its effect on overall performance. To achieve this, the BIOS of the computer and its operating system would have to be bypassed to write directly to the disk controller. This would involve assembly routines that addressed the hardware directly, another set of routines that called the BIOS functions and finally one that used the operating system's filing functions.

As we are primarily interested in the implications of disk speed for the end user and want the tests to be straightforward and portable, we decided to dispense with the low-level tests and stick with calls through the operating system. Our tests then, record the time it takes the computer to perform disk operations, rather than the speed of the disk itself. They are, for example, sensitive to clock speed.

Recent versions of Core International's

Coretest utility are available for those wishing to test the performance of a disk in isolation from the computer. Beware of version 2.1 and earlier — they do precisely what our test does and test the combination of computer and disk speed.

There are two tests: sequential and random.

The sequential test opens a file and appends a number of records to it. We used four files and ran the test on each file five times. The number of iterations required for a stable test result is spread over all 20 tests and the dummy loop repeats all file opens, replacing only the actual write statement.

The four files consist of 79-byte records plus carriage return/line feeds. The number of records in the individual files was 21, 304, 6 and 40.

A number of 55-byte records are appended to each file. This number is arranged by the Basic program so that each test appends a different number of records, and so the total number is equal to the number of tests required for a stable result.

The random access test does 300 reads and 100 writes to a file of two thousand 46-byte records. These reads

Philosophy behind benchtests (continued)

there are other things that are equally important.

For example, the speed of the disk drive may affect the speed at which your application runs far more than the CPU speed does. If you are using the machine for word processing, for example, then the disk drive speed will directly affect the speed at which your computer retrieves files from the disk, or saves them to disk.

Similarly, if you do a lot of desktop publishing, the video circuitry speed will affect the speed at which your application runs. CPU speed and disk speed will affect it also.

So the actual speed at which your computer runs — the speed at which it does what you ask it to do — depends not only on CPU speed, but also on memory, disk and video speed.

Not only that, but for any comparison between machines, you have to know what applications you are likely to use, because each machine will operate at a different speed with each application.

However, it's not as bad as it seems;

most applications within an application area (ie. word processing, database management, spreadsheeting) will give the same measure of speed on the same machine. So you will only need to know which application areas interest you to know which machine will operate fastest for you.

With performance benchmarking, we tested each machine in two ways. The first was in the 'traditional' manner, using programs that measure the speed of the disk drive, the CPU, memory and video separately. Then, we tested using specific applications — one from each application area — to find out how the machine performs as a whole.

Tests used

One of the difficult aspects of benchtesting hardware is to design software that accurately tests the hardware function and not its particular implementation of the software being used to test it. However, with applica-

and writes start at opposite ends of the file and work their way towards the middle.

The test is repeated until a stable number of tests has been performed.

Video controller

A number of factors affect video performance.

Obviously, as the XY resolution and pixel depth increases, the number of operations required to update a given area of the screen will also increase. Paradoxically, the performance of the video hardware has improved so that the time taken on these higher resolution systems is on par with that of lower resolution ones. This effect is noticeable in high performance systems, but can also be seen at the low end. The improvement in performance shown in the EGA over the CGA adaptor is a result of the use of hardware support to allow multi-plane screen memory updates on the EGA adaptor with single write operations by the host CPU.

Hercules/MGA systems performed much faster on the text-based tests than the more graphically oriented EGA and VGA cards tested.

tion software, this is almost impossible. The software was not designed as a performance test, but as a functional application. To accurately compare two different hardware platforms, it is necessary to run a range of software packages from the same application area and combine the results.

The MS-DOS world is dominated by the need for compatibility — all MS-DOS machines run the same software. The same instructions are generated for an 8088-based XT compatible as the latest PS/2 Model 70. Eventually, software will appear that takes full advantage of the 80386 processor and its vastly enhanced instruction set. When that day comes, owners of machines based on older Intel chips will have to start thinking about using them as anchors, but until then they have machines which are functionally equivalent although somewhat less powerful.

Because of this, it is quite valid to run a simpler set of tests across the range of MS-DOS machines, comparing the times they take to run a particular software package.
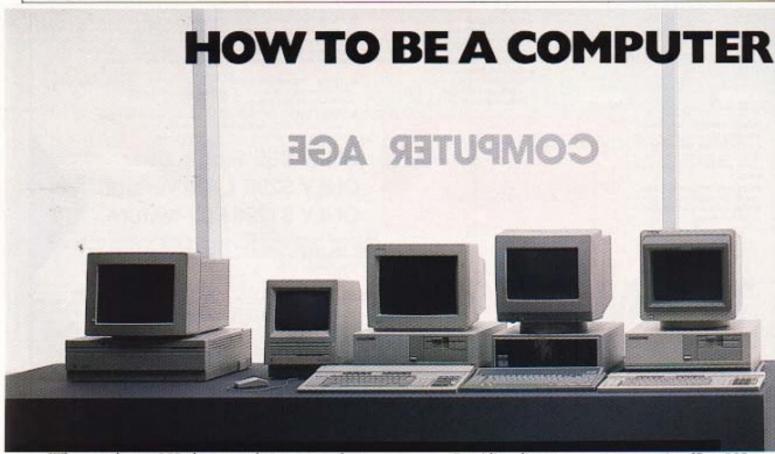
As we set out to test the largest number of machines possible, we accepted this limitation and chose popular, well tried and much enhanced applications from each application area.

The cost is that this month we are unable to publish results for other hardware platforms. dBASE Mac, for example, took over five hours to perform exactly the same test on a Macintosh Plus that a 10MHz XT compatible completes in about 18 minutes. I am sure this is not a good indicator of the potential of the Macintosh, and the less said about the implications for Ashton-Tate, the better.

Our application results are based on the following tests.

Word processing

We chose the best-selling word processor for MS-DOS machines, WordPerfect. When we compare the different hardware platforms (the Mac,

HOW TO BE A COMPUTER

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Video systems suffer from a latency problem associated with a conflict occurring between the host CPU and the video refresh logic. When accessing the screen memory this can cause the dreaded 'snow' or screen hash.

If snow is not to be seen on-screen, when video memory is being written to, the updating must take place when the video retrace or blanking is occurring. The screen is blank at this time. Unfortunately, the screen is active (unblanked) most of the time.

As a result, screen memory writes only take place every one in five video memory cycles (in resolutions of 640 by 350 and above). In systems with dedicated graphics coprocessors this is not a major problem, as the host CPU passes high-level graphics commands to the graphics processor. The coprocessor then executes them in parallel without the host having to wait for the video to blank.

An alternative solution is double buffering. This is where two distinct copies of the screen buffer are used (while one buffer is displayed the other is updated). However, you have to pay for twice the amount of screen RAM.

The way that video information is

Philosophy behind benchtests (continued)

for example) in the first few months of 1989 we will run similar tests in a variety of packages.

The following operations are timed using a macro:

- Time taken for a file of 25,000 words (available on MS-DOS 90mm and 135mm format) to be read in.
- Time taken to find the end of the file. The test then returns to the beginning.
- Time taken to find and replace the 1473 occurrences of the word 'replace' with the letters 'xxx'.
- Time taken to return to the beginning of the file and find and replace all 'xxx' with the word 'replace'.
- Finally, time taken to return to the beginning of the file, scroll down 200 lines and backspace through 800 characters, destroying them as it goes.

The total time to complete this test is recorded.

Spreadsheet

We used Lotus 1-2-3 supplied by Im-

agineering. Like the word-processing test, this was encapsulated in a macro to avoid keyboard delays.

- A '1' is entered in cell A1.
- Cell A2 is made to be 'cell above * 1.001'.
- Cell A2 is copied to cells A3 to A50.
- Cell B1 is made to be 'A50 * 1.001'.
- Cell B2 is made to be 'cell above * 1.001'.
- Cell B2 is copied to cells B3 to B50.
- Cells B1 to AW50 are copied to cells C1 to AX50.

The process is repeated with a '2' in cell A1, and 1.001 replaced with 1.002. Automatic recalculation is left on making this half of the test significantly slower than the first.
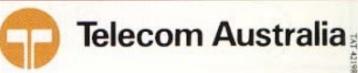
Desktop publishing

InfoMagic supplied us with PageMaker 3, which we pre-installed for EGA colour cards and Hercules cards. We stripped it of every font not necessary for the test and loaded the pre-installed software onto the test machine. Unfortunately,

stored in the screen memory (mapping) also affects performance. There is a problem with granularity where pixels are mapped as bits in a byte. This will result in eight pixels being accessed even if only one pixel is to be updated. Another inefficiency occurs where multiple planes have to be manipulated even when only one pixel is being modified.

Surprisingly, the new greyscale/256 colour systems are faster to update as they use a linear display buffer mapping. Writing a single byte in this system updates a single pixel to one of 256 colours (or grey levels) instead of performing the read-modify-write and plane selection operations required on older systems.

The routines in our suite of tests give an index to the rate that average video operations will occur.

Because they are written in Basic, they do not address the video hardware directly and cannot test the potential of each video controller. A specific application that is video I/O intensive can be optimised for any given hardware setup. This is to achieve the best performance possible by utilising any extra hardware features or working around bottlenecks inherent in the video system.

In general, applications' portability is

Philosophy behind benchtests *(continued)*

macros are not available in PageMaker and we had to enter the necessary keystrokes accurately and quickly.

The word-processing document (see WP test) had been loaded into A4 pages in one column using 12-point text and saved as a document.

The time to load the document, go to the last page and display it at 75 per cent in one movement is recorded.

This test was the most difficult to time. The stopwatch was started — after the file to be opened had been named — on the press of the enter key. The keyboard shortcuts to go to the last page and display text at 75 per cent full size had to be entered before the document loaded. On the faster '386 machines this meant eight accurately typed entries and two stop watch movements in less than six seconds. The time to cut the first 10 pages and redraw while viewing the last page is recorded.

The time taken to convert the complete document to bold, back to normal, right justify it and return to normal is recorded.

Database

What else, but the ubiquitous dBASE? Imagineering supplied dBASE IV, which we again stripped down to the absolute minimum to save file loading time. We also used dBASE to pick up the results from the low-level tests, prompt the tester for the recorded times in the other applications, divide the results of an IBM XT by those of the test machine, and write the results to a floppy disk.

A large ASCII file (available on MS-DOS 90mm and 135mm format) is read into the file format shown below and saved as a database file.

A list of 33 keys, 27 of which are on the large file, is also saved. The following times are then recorded:

● Time taken to open the file and list the first 400 records.

● Time taken to search the large file sequentially for the first 20 keys in the file of keys.

● Time taken to index the file on the first five characters of the first field, and

the most significant feature affecting video performance. If the application you are running is designed for any type of system, it will be by necessity very general and will not use hardware specific features available on individual systems.

An example is programs that are designed to run on 'IBM compatible' computers, but call the ROM BIOS when displaying something on the screen. (Or a growing list of 'standard' graphics interfaces such as Windows, GEM, OS/2's GPI etc.)

Routines to call the video hardware directly would have to be rewritten for every piece of hardware.

The video benchmarks can be divided into two sections: text and graphics mode operations.

Some systems perform all video operations in graphics mode (Apple's Macintosh), whereas others (IBM PCs and compatibles) have two distinct modes of operation when performing video I/O. In text mode on PCs and compatibles, a single write to the screen memory area will cause the video hardware to display a fully formed character on the screen; whereas a system that uses graphics mode only would require dozens of instructions (at least) to be executed to display a single character.

We have therefore included routines that exercise both modes.

Also, the text display routines exacerbate this problem when run on graphics only systems by doing 'random' cursor addressing and scrolling of text. This test will show the advantages of hardware text generation in applications such as word processing or spreadsheets, even though the new generation of word processors and spreadsheets is moving into graphics mode operation. Such operations are being driven by higher speed CPUs more than improvements in video hardware.

The impact of the host CPU speed on video performance cannot be disregarded, especially in systems such as Apple's Macintosh (pre-graphics coprocessor versions), or graphics interfaces such as Windows.

The dot-plot routine writes dots in a diagonal line down the screen to ensure that no speed advantage can be seen by the order of the dot plotting coinciding with the mapping of the screen memory.

Memory tests

Compared to video and disk controllers, memory is a relatively simple device. A memory chip receives an input (the address of a memory location) and returns the contents of that location as its out-

to index the file on the first 15 characters of the second field, search for records with the keys supplied in the key file, delete them and re-index the file.

All times are added together.

Files used to perform tests

LARGE.WP The word processing and desktop publishing raw ASCII document.

Field	Field name	Type	Width	Dec
1	RANDCODE	Character	6	
2	ALPH1	Character	20	
3	ALPH2	Character	30	
4	NUM1	Numeric	5	
5	DAY1	Date	8	
6	ALPH3	Character	30	
TOTAL				100

TEST.TXT ASCII data for the large database file.
KEYFILE.TXT List of keys for searching test.txt.

The file format for the database file is as follows.

Structure for database: C:test.dbf
Number of data records: 3533
Date of last update: 11/01/88

Geoff Ebbs and Phil Cohen

put. It is a simple switching device.

The speed rating of a memory chip is the time it takes to switch on the output after receiving the input signal. Although this time is measured in thousandths of millionths of a second, memory chips can still cause delays in the execution of an instruction. If all memory were connected directly to the CPU, calculating

the effect of memory on performance would be simple — it would either cause each instruction that accessed memory to wait or it would not. Modern technology is not that straightforward (which is unfortunate for those of us designing benchtests, but lucky for those with fast CPUs!)

Memory caching is the most common

"Go, wondrous creature! Mount where Science guides,
Go, measure earth, weigh air, and state the tides;"
— *Alexander Pope: An Essay on Man.*

Sunday morning — the hills north east of Melbourne.

While a roast sizzles patiently for me in an oven some kilometres away, I unfold my portable in the offices of Terran Computer. Another *APC* benchtest is about to take place.

I will put the computer through a gruelling set of low-level tests that look at one hardware function at a time. It will then load some standard applications, (word processing, database management, spreadsheet and desktop publishing), and put them through their paces with standard data files, ask a series of questions about the standard configuration of the computer and finally, spit out a result.

What we are looking for is the best computer for the average business

user. We have made the assumption that we are buying a standalone system and that performance is an important consideration.

I have tried to avoid the temptation of being blinded by speed. Power, reliability and usability are all factors that count to the consumer. There is a danger that, having designed a set of tests, one comes to believe in them as if they held a magic key. To complete the quotation from Pope, "Go, teach Eternal Wisdom how to rule —
Then drop into thyself, and be a fool!"

The facts are though, that speed in computing devices is critical.

We use them for more aspects of our working life everyday, and to keep the master-slave relationship the right way round, the computer must be fast enough not to have to adjust our pace to work with it.

APC's new benchmarks are the first step towards an industry-standard method of testing computer performance. We have developed them in association with peripheral manufac-

method of increasing speed. Caches generally use static RAM — which does not need to be refreshed and is consequently faster — to store chunks of regularly-accessed memory. Obviously, the algorithm used to determine what should be cached and the size of the cache itself will play a major role in determining the performance of memory.

Our tests are quite simple. We transfer a 4k block of memory from one location to another enough times to give a stable timing. This test will nearly always be performed within the cache itself. We then transfer a much larger block of memory that would not fit into any memory cache. The two results are combined to give an index of the memory performance.

Processor performance

Strictly speaking, there is no such thing as a CPU test. A given brand of processor has a fixed instruction set. When driven at a particular clock speed it will always perform those instructions in the same time. Any variations are not introduced by the CPU, but by peripheral devices.

One can meaningfully compare the

turers, software developers and Standards Australia. The Terran is the tenth computer to be tested with them.

Perhaps because it is Sunday and the birds sing with an irreverence that only appears in the absence of traffic, the Terran seems particularly unperturbed by the armoury of devices I have brought with me. Its footprint is similar to that of a small PS/2 Model 30 and it has a very low-profile box. I attempt to put Saturday night well behind me with a cup of coffee while this beast goes through the low-level tests. They take about 10 to 15 minutes on the average XT.

Suddenly, it is finished. This innocent looking thing really packs some punch.

Australian designed, the Terran is a very powerful little box. In fact, it is the fastest 16MHz '286-based machine we tested. Peter Nunn of Terran Systems has put considerable effort into designing smart controllers on the motherboard and it seems that his efforts have paid off.

In fact, the reason that we have never

reviewed this machine is that he is always in the middle of improving some aspect of it and, each time, he would prefer to have it reviewed after the improvement is made. I for one was thankful for its speed — the roast remained succulent and the peas juicy.

No doubt it is that design expertise which led to Intel's appointment of Terran as its first Australian independent design centre.

Two machines reviewed in last month's *APC* also gave interesting results. The Apricot Qi 310 is one of three 80386SX machines that we tested and, like the others, it indicates just how powerful the SX is for standalone work. (Not that our tests indicate it lacks punch in a multi-user situation, they are simply not designed to supply that information.)

It is also the first non-IBM machine released to use IBM's new Micro Channel bus. As such, it is difficult to compare it with its peers — we can simply conclude that it is possible to build slightly faster machines with the full
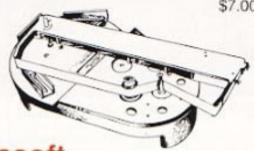
time it takes compatible CPUs, like the V20 and the 8086, to perform the same instructions. The results of such a test should match the specifications of the processor given in the device manual.

The Sieve of Erastothenes test actually uses the stack, indirect memory addressing, comparison operations and lots of integer arithmetic. It is a processing rather than a processor test. We used it because it is a popular test among language and system designers and covers most of the functions apparent in any processor's heavy application.

Being a prime number sieve, it does not test floating-point operations. The code for the floating point and the memory transfer tests has not been published in this issue due to space considerations. That code, along with the code published here, is available for downloading from Microtex (page reference 6663757) on Telecom's Viatel; or by sending a blank formatted 5.25in disk with a stamped, self-addressed package to Jean Lowers, 124 Castlereagh Street, Sydney 2000.

CREATDAT.BAS creates the data files. BNCHTEST.BAS (listed in this article) runs the basic tests, while MEMORY.C and PROCESS.C contain the major routines for the memory and processing tests.

PCs on test
(continued)

'386 — Apricot itself has done it with its Unix box — and that so far, none of the real speed kings have set their minds to thrashing the Micro Channel architecture; Compaq's 16MHz SX machine runs faster than the Qi.

IBM turned in quite respectable results. Rather, the IBM machines did. IBM could not find any test machines and put us onto its dealer network for assistance. BS Microcomp came to the party and supplied the machines in a very interesting location. My first visit to the vaulted innards of the Sydney harbour bridge.

The IBM machines are not lightning fast — they run at slow clock speeds. We tested a Model 80, running at 12MHz, and it competes well with machines doing 16 million cycles each and every second. The PS/2 Model 30 '286 outperformed the other 10MHz '286 machines. Not that you'd invest in a 10MHz clock speed machine if you wanted performance.

Getting back to speed kings, the other machine reviewed last month

was the Compaq SLT/286. (Despite it's squat and, to my mind, ugly shape, I fell for Compaq's 'sexy-little-thing' hype and can't remember its other acronym). It puts in better than respectable performance for a 12MHz '286 and has extremely fast video. It was tested in portable mode, with the power strobing shutting down the hard disk after a short period of inactivity. The delays caused while the hard disk fires up give a somewhat low disk performance rating and explain the difference between the low-level tests and the application tests, which all have some disk access.

It was just pipped at the post on nearly all tests by the brand new 3100e from Toshiba. This machine had not been released at the time of writing, but is very fast indeed. It does not have Compaq's unique VGA video and is bound to be far more power hungry with its electro-luminescent screen and straight MOS technology.

Another new release, tested at the Brisbane Computer Expo, was the

Combining results

Having tested these separate functions and produced a series of numbers, the problem is now to indicate their significance.

A fairly readily understood quantity would be the relationship to another machine. We took the original IBM XT running at 4.77MHz as a base machine. This was really the first workable version of the IBM PC range, and it is around that architecture that all PC compatibles have been built.

It is horribly slow, but people still use it. I actually threw an IBMer off her desk to run the tests. To compensate for this intrusion, I left her hard disk nicely compressed and a note indicating just how slow the thing was compared to today's best — just in case she needed ammunition to requisition an upgrade.

The IBM XT results are as follows.

Machine: IBM PC-XT

Disk	29.91
Video	13.70
Memory	72.9
CPU	66.3
WP	416.0
1-2-3	192.0
dBASE	1525.0
DTP	287.0

The application results are the times in seconds as they actually are recorded by the programs or stopwatch. The Disk and Video results are the indices as calculated by the Basic programs, the Video and Memory results are those returned by the C programs.

Running the tests described here and dividing these figures by your machine's results will tell you how many times faster than an IBM XT your machine performs particular operations. You can directly compare your figures with those on the wall chart, accompanying this issue, to see how your machine stacks up against others on the market today.

We have combined the results from each of the video and disk tests to give an index for those hardware functions using a geometric mean. In the same way, we have combined the results from each of the low-level tests to give a performance index and of the applications programs to give an application index. The *APC* index is the geometric mean of the performance and application indices.

Geometric mean

Most people will be familiar with the concept of average. If you have three people in the room, whose ages are 30,

40 and 50, then their average age is 30 plus 40 plus 50 divided by 3, which is 40.

Another name for this type of average is an 'arithmetic mean'. It's fine for finding average ages, but not much use in combining benchmarks.

Why? Because it doesn't give large and small numbers the same weighting. Let's say that we have two machines, A and B, and we apply three benchmarks, BM1, BM2 and BM3, and get the following results:

	Machine A	Machine B
BM1	1	5
BM2	11	11
BM3	12	12
Average	8	9

Because BM1 gives a generally smaller result than BM2 or BM3, the effect on the average of increasing BM1, even by a factor of five, is not very significant.

The geometric mean uses a different (although mathematically very similar) approach, which gives the same importance to numbers that are large *and* small. To calculate the geometric mean, you multiply all of the benchmark results together, then take (in this case) the cube root of the result:

	Machine A	Machine B
BM1	1	5
BM2	11	11
BM3	12	12
BM1*BM2* BM3 =	132	660
Geometric mean	5.1	8.7

PCs on test

Exzel 386. There is not much that is remarkable about this machine, except that it comes from New Zealand. It is a desktop '386 with a slightly smaller than average footprint and its performance falls squarely in the middle of its peers.

There were some duds, indicating that design is everything, but these generally came from companies intent on marketing an aspect other than performance. Price being the most common feature quoted in these cases.

Unfortunately, our tests indicate almost nothing about reliability, which in many instances is of more concern to the purchaser than speed. Importers like Logicraft, which emphasises the reliability of its boxes, are naturally disappointed about this. Without borrow-

ing their machines for a couple of months and doing really, really horrible things to them, I cannot imagine how we could test this.

What we have set out to develop is a method of quantitatively measuring computer performance as it relates to an ordinary user. We have also introduced a usability index as a first step toward quantifying the limitations placed on a worker by his/her desktop tools.

Most importantly, we have combined the more traditional low-level benchmarks with real world applications. As indicated by the tests on portables which shut down the hard disk to save power, these often pick up things that pure hardware tests will miss.

Geoff Ebbs

The geometric mean provides a more satisfactory way of combining results which are likely to be of different sizes.

The cube root is used in this example because there are three numbers involved (BM1, BM2 and BM3). If there had been four, we would have used the fourth root.

Usability benchmarking

Benchmarking the performance of a computer is only one way of measuring its worth. Other factors include the memory size, the footprint (ie, the amount of desk space the computer takes up), the number of expansion slots, and of course, the price. But how do you combine these numbers to produce a meaningful figure?

To simplify the choice for our readers, we developed a usability index, which simply takes the pain out of looking at tables of machine specifications, and allows you to make a quick and accurate assessment of just how these numbers compare.
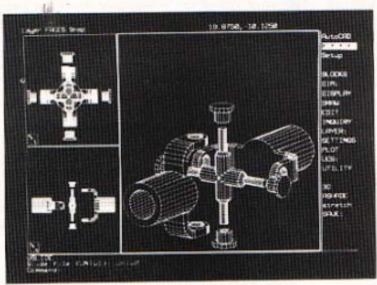
We calculated for each variable — memory size, footprint, slots, price — an index figure which varies from 1 (very poor) to 10 (excellent).

Naturally, the scaling of these figures is a little arbitrary. We decided what the average machine would contain in two year's time, fixed this as the mid-point of our scale, then fixed the upper and lower ends at the best and worst conceivable figures and tried to find functions that fitted all three points.
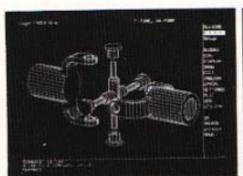
For example, we decided that the average computer would have four available slots, excluding those taken up with

BENCHMARKS

standard cards such as the drive controller and video interface. So we set the mid-point of the slots index at four. Then we decided that the worst possible number of available slots was zero, and that nine would be as large as you could hope for. This gave a very simple calculation: take the number of available slots and add one to give the slot index.

The calculation for footprint was a little more difficult. First, we decided that the footprint should be the area of the computer plus the area of the keyboard. We then set the mid-point at 3400 square centimetres (somewhere around that of an XT), and the top at 600 (about as small as a keyboard can get). The bottom of the range came out at 5640 (the size of a small desk). The calculation of footprint index is: 10-(footprint-600)/560.

For memory, we decided that a linear relationship would not give a true representation, so we chose a logarithmic one. The calculation is: (log2('memory in k'/64)*1.25)+1. This gives a 64k machine an index of 1, a 640k machine an index of 5, and anything over 16Mbytes an index of 10.

It is rounded to the nearest integer by our Basic code, which has had to emulate a logarithmic function by counting divisions by 2.

```
/*
**   SIEVE.C
**
**   Erastosthenes Prime Number Sieve Benchmark
**   After Byte Sieve Benchmark
*/
/*
---------------------------------------------------
----------- ------------ */
/*
XX   Defines
*/
    #defineLINT_ARGS
    #defineRANGE10000
    #defineFILLCHAR'X'
/*
---------------------------------------------------
----------- ------------ */
/*
XX   Include Files
*/
    #include.h
    #include.h
    #include
    q.h
    #includealloc.h
    #include.h

    #includeadef.h

    #include"benchlib.h"
/*
---------------------------------------------------
----------- ------------ */
/*
XX   Local variables
*/
    LOCALCHARprime [RANGE] ;
/*
---------------------------------------------------
----------- ------------ */
/*
XX   Local functions
*/
    LOCALFLTsieve_test ( UINT ) ;
/*
---------------------------------------------------
----------- ------------ */
GLOBAL VOID main (argc, argv)
/*************************/
INT argc ;
PTR argv [] ;
{
    UINTrepetitions ;
    FLTtime_elapsed ;

    FILE*fp ;
    /* - - - - - - - - - - - - - - */
    puts ("Beach Computer Systems") ;
```

```
    puts ("Sieve Prime Number Benchmark    V1.00") ;
    repetitions = benchmark_args (argc, argv) ;
    repetitions /= 100;

    /*
    **Start the test...
    */
    benchmark_identify () ;
    start_clock () ;
    /*
    **Do the test...
    */
    time_elapsed = sieve_test (repetitions) ;

/*
    **Print the result
    */
    fp = fopen ("SIEVE.DAT", "wb") ;
    if (fp == NULL)
    {
    puts ("Couldn't open SIEVE.DAT") ;
    exit (5) ;
    }
    fprintf (fp, "%.2f", time_elapsed) ;
    fclose (fp) ;
    benchmark_results (repetitions, time_elapsed) ;
}   /* main () */
/*
---------------------------------------------------
----------- ------------ */
LOCAL FLTsieve_test (iterations)
/*****************************/
UINTiterations ;
{
    UINTi, j, k ;
    UINTcount, prime_no ;
    /* - - - - - - - - - - - - */
    for (i = iterations ; i  0 ; -- i)
    {
    count = 0 ;
    memset (prime, TRUE, RANGE) ;

    for (j = 0 ; j  RANGE ; ++ j)
    {
    if (prime [j])
    {
    prime_no = 2 * j + 3 ;
    for (k = j + prime_no ; k  RANGE ; k += prime_no)
    prime [k] = FALSE ;
    ++ count ;
    }
    }
    }
    return (check_clock ()) ;
}   /* sieve_test () */
/*
---------------------------------------------------
----------- ------------ */
/* END OF SIEVE.C */
```

C listing for video and memory tests

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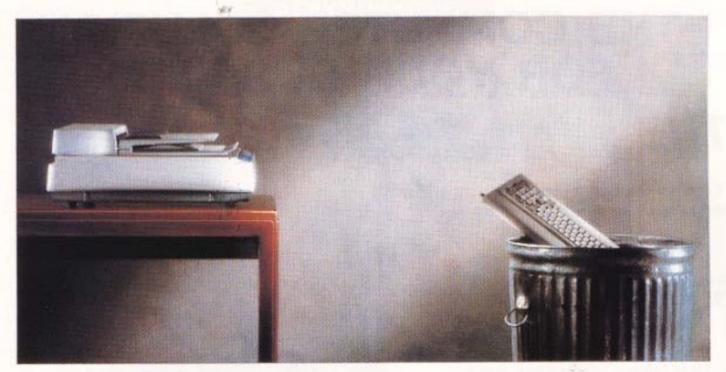
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```
10 REM APC Benchmarks Copyright 1988
   ****************************
20 REM Initial setup gets information for
   describing machine
30 REM and for calculating Usability Index
40 INPUT "Name of computer? (use no blanks)
   ",CNAME$
50 INPUT "Name of processor? ",PNAME$
60 INPUT "Speed of processor? (MHz) ",PSPEED
70 PRINT
80 PRINT "Please check these responses"
90 PRINT "Computer: ";CNAME$
100 PRINT "CPU: ";PNAME$;" at ";PSPEED;"MHz"
110 INPUT "Enter C to make any changes ",RESP$
120 IF RESP$ = "c" OR RESP$ = "C" THEN GOTO 30
130 PRINT
140 INPUT "Name of disk? ",DNAME$
150 INPUT "Disk capacity (Mb)? ",DCAPAC$
160 INPUT "Disk speed (ms)? ",DSPEED$
170 INPUT "Number of available slots? 0.5 for
    half length ",XSLOTS
180 PRINT
190 PRINT "Please check these responses"
200 PRINT "Using a ";DCAPAC$;"Mbyte ";DNAME$;" at
    ";DSPEED$;" milliseconds"
210 PRINT "With ";XSLOTS;" expansion slots."
220 INPUT "Enter C to make any changes ",RESP$
230 IF RESP$ = "c" OR RESP$ = "C" THEN GOTO 140
240 PRINT
250 INPUT "Memory capacity? (kb) Use 1024 for
    Mb. ",MCAPAC
260 INPUT "Memory chip size? ",MCHIP$
270 INPUT "Memory speed? (ns) ",MSPEED$
280 PRINT
290 PRINT "Please check these responses"
300 PRINT " and ";MCAPAC;" of
    ";MSPEED$;"nanosecond ";MCHIP$;"k RAM"
310 INPUT "Enter C to make any changes ",RESP$
320 IF RESP$ = "c" OR RESP$ = "C" THEN GOTO 250
330 PRINT
340 INPUT "Video adapter? ",VNAME$
350 INPUT "Colour or mono? ",VCOLR$
360 INPUT "Video RAM capacity? ",VCAPAC$
370 PRINT
380 PRINT "Please check these responses"
390 PRINT " and a ";VCOLR$;" ";VNAME$;" with
    ";VCAPAC$;" of video RAM"
400 INPUT "Enter C to make any changes ",RESP$
410 IF RESP$ = "c" OR RESP$ = "C" THEN GOTO 340
420 INPUT "Depth of computer (or monitor if
    bigger) in cm ",CDEPTH
430 INPUT "Width? ",CWIDTH
440 INPUT "Depth of keyboard? ",KBDEPTH
450 INPUT "Width of keyboard? ",KBWIDTH
460 INPUT "Rec retail price including tax? ",PRICE
470 PRINT
480 PRINT "Please check these responses"
490 PRINT "Width ";CWIDTH;" Depth ";CDEPTH"
    Keyboard ";KBWIDTH;" x ";KBDEPTH;"cm"
500 PRINT "Price",PRICE
510 INPUT "Enter C to make any changes ",RESP$
520 IF RESP$ = "c" OR RESP$ = "C" THEN GOTO 420
530 REM Calculate Usefulness index
540 XSLOTNDX = XSLOTS + 1
550 FTPRT = CWIDTH*CDEPTH + KBWIDTH*KBDEPTH
560 FTPRTNDX = 10 - (FTPRT - 600)/560
570 PRINT FTPRTNDX", ftprt ",XSLOTNDX", slots"
580 REM Calculate the memory index
590 MVAR = MCAPAC/64
600 MVAR = MVAR*SQR(SQR(MVAR))
610 MEMNDX% = 0
620 REM Get the clsoest integer to (log base 2 of
    mvar) + 1
630 MEMNDX% = MEMNDX% + 1
640 MVAR = MVAR/2
650 IF MVAR = 1 THEN GOTO 630
660 PRINT MEMNDX%", Standard Memory Index"
670 REM Calculate the price index
680 MIDPRICE = 6000
690 PRICENDX = (MIDPRICE - PRICE)/1000
700 IF PRICE  MIDPRICE THEN PRICENDX = PRICENDX/5
710 PRICENDX = PRICENDX + 5
720 PRINT PRICENDX", Price Index"
730 USABIL = 10
740 IF PRICENDX = USABIL THEN GOTO 770
750 USABIL = PRICENDX
760 REASON$ = "Price"
770 IF MEMNDX%  USABIL THEN GOTO 800
780 IF USABIL = MEMNDX% THEN REASON$ =
    REASON$+"Memory" ELSE REASON$ = "Memory"
790 USABIL = MEMNDX%
800 IF FTPRTNDX  USABIL THEN GOTO 830
810 IF USABIL = FTPRTNDX THEN REASON$ = REAS-
    ON$+"Footprint" ELSE REASON$ = "Footprint"
820 USABIL = FTPRTNDX
830 IF XSLOTNDX  USABIL THEN GOTO 860
840 IF USABIL = XSLOTNDX THEN REASON$ =
    REASON$+"Slots" ELSE REASON$ = "Slots"
850 USABIL = XSLOTNDX
860 PRINT REASON$;" is the limiting factor for
    this machine"
864 PRINT ""
865 REM Find the number of iterations required to
    stabilise results
870 REM seed the variable iterate
880 ITERATE = 1
890 REM Set up variables to time 10 tests with
    less than 5% variation
900 ITERATE = ITERATE * 2
910 SHORTIME = 60000!
920 LONGTIME = 0
930 GOODLOOP = 0
940 REM Wait a random amount of time
950 FOR I% = 1 TO (INT(RND*1000) + 1)
960    A% = I%
970 NEXT I%
980 REM Test the current value of iterate
990 BEGIN = TIMER
1000 FOR I% = 1 TO ITERATE
1010    FOR J% = 1 TO 100
1020    NEXT J%
1030 NEXT I%
1040 FINISH = TIMER
1050 ELAPSED = FINISH - BEGIN
1060 PRINT ITERATE;"hundred iterations took ";
     ELAPSED;" seconds on the ";GOODLOOP+1;"th try"
1070 REM Set lowest and highest times and
     increment counter if good
1080 IF SHORTIME  ELAPSED THEN SHORTIME = ELAPSED
1090 IF LONGTIME  ELAPSED THEN LONGTIME = ELAPSED
1100 IF SHORTIME/LONGTIME  .95 THEN GOODLOOP =
     GOODLOOP + 1 ELSE GOTO 890
1110 IF GOODLOOP  10 THEN GOTO 940
1120 ITERATE = ITERATE*100
1130 REM Slow computer down to give reasonable
     timings
1140 START = TIMER
1150 FOR I% = 1 TO ITERATE
1160    X$ = "x"
1170 NEXT I%
1180 FINISH = TIMER
```

Source code for the SIEVE program

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```
1190 ELAPSED = FINISH - START
1200 IF ELAPSED  2 THEN SLOWDN% = 1 ELSE SLOWDN%
     = INT(2/ELAPSED)+1
1210 PRINT "Using ";SLOWDN%;" x ";ITERATE;"
     iterations to give at least ";
     ELAPSED*SLOWDN%;" secs."
1220 REM Now, pace the clock speed against a
     stop watch
1230 REM Allow for up to 5 tests
1240 ELAPSED = 0!
1250 DIM ELAPSED(5)
1260 DIM RATIO(5)
1270 H% = 0
1280 H% = H% + 1
1290 PRINT "Hit return when ready with your
     stopwatch"
1300 INPUT "The machine will output the word
     NOW when ready",A$
1310 FOR I% = 1 TO ITERATE
1320     FOR J% = 1 TO SLOWDN%
1330         X$="x"
1340     NEXT J%
1350 NEXT I%
1360 PRINT "NOW"
1370 START = TIMER
1380 FOR I% = 1 TO ITERATE
1390     FOR J% = 1 TO SLOWDN%*10
1400         X$ = "x"
1410     NEXT J%
1420 NEXT I%
1430 WRITE "STOP"
1440 FINISH = TIMER
1450 ELAPSED(H%) = FINISH - START
1460 PRINT "Computer recorded ";ELAPSED(H%);"
     seconds."
1470 INPUT "Enter your time? ",HUMAN
1480 RATIO(H%) = HUMAN/ELAPSED(H%)
1490 REM Check the agreement between timer and
     clock
1500 IF RATIO(H%)  1.05 AND RATIO(H%)  .95 AND
     H% = 1 THEN RATIO = 1 ELSE RATIO = 0
1510 IF RATIO = 1 GOTO 1660
1520 REM If  result disagrees try again
1530 IF H% = 1 GOTO 1280
1540 REM Compare previous two results
1550 TEST = RATIO(H%)/RATIO(H%-1)
1560 IF TEST  1.05 AND TEST  .95 THEN RATIO =
     (RATIO(H%)+RATIO(H%-1))/2
1570 REM For widely varying results get five
     values
1580 IF RATIO  0 THEN GOTO 1660
1590 IF H%  5 GOTO 1280
1600 FOR I% = 1 TO 5
1610     PRINT RATIO(I%)
1620     RATIO = RATIO + RATIO(I%)
1630 NEXT I%
1640 RATIO = RATIO/5
1650 NEXT I%
1660 PRINT "Using a clock factor of ";RATIO;" in
     all calculations."
1665 REM Write a file for C programs to use
1670 OPEN "O",1,"iterate"
1680 WRITE#1, ITERATE*SLOWDN%
1690 CLOSE #1
1710 SCREEN 0:WIDTH 80
1730 REM     Clear Screen Test
1740 REM
1750 START = TIMER
1760 FOR I=1 TO 100
1770     CLS
1780 NEXT I
1790 MID = TIMER
1800 FOR I=1 TO 100
1810     REM dummy
1820 NEXT I
1830 FINISH = TIMER
1840 CLRSCR = 2*MID - (START+FINISH)
1850 REM     Direct Cursor Addressing and Text
     Display Tests
1860 REM
1870 H% = ITERATE/1920 + 1
1880 START = TIMER
1890 FOR J = 1 TO H%
1900 CLS
1910 FOR I = 1 TO 1920
1920     X=(I MOD 79) + 1:Y=(I MOD 23)+1:CODE=X+32
1930     LOCATE Y,X
1940     PRINT CHR$(CODE);
1950 NEXT I
1960 NEXT J
1970 MID = TIMER
1980 FOR J = 1 TO H%
1990 CLS
2000 FOR I = 1 TO 1920
2010     X=(I MOD 79) + 1:Y=(I MOD
     23)+1:CODE=X+32
2020     REM dummy
2030     A$ = CHR$(CODE)
2040 NEXT I
2050 NEXT J
2060 FINISH = TIMER
2070 CLS
2080 CURSOR = (2*MID - (START+FINISH))/H%
2090 REM
2100 REM     Scrolling Test
2110 REM
2120 T$="":FOR I=32 TO 111:T$=T$+CHR$(I):NEXT I
2130 START = TIMER
2140 FOR I=1 TO 100
2150 PRINT T$
2160 NEXT I
2170 MID = TIMER
2180 FOR I=1 TO 100
2190 A$=T$
2200 NEXT I
2210 FINISH = TIMER
2220 SCROLL = 2*MID - (START+FINISH)
2230 REM
2240 REM     Graphics Tests
2250 REM
2260 SCREEN 1
2270 START = TIMER
2280 H% = ITERATE/4000 + 1
2290 FOR J = 1 TO H%
2300 FOR I=0 TO 3999
2310     X=I MOD 320:Y=I MOD 200
2320     PSET(X,Y),1
2330     V=POINT(X,Y)
2340 NEXT I
2350 NEXT J
2360 MID = TIMER
2370 SCREEN 0
2380 FOR J = 1 TO H%
2390 FOR I=0 TO 3999
2400 X=I MOD 320:Y=I MOD 200
2410     REM dummy
2420     REM dummy
2430 NEXT I
2440 NEXT J
2450 FINISH = TIMER
2460 WIDTH 80
2470 GRAPH = (2*MID - (START+FINISH))/H%
2480 VIDEONDX = SQR(SQR(CLRSCR*CURSOR*SCROLL*
     GRAPH))*RATIO
2500 REM Disk tests for random and sequential
     files
```

```
2510 REM Initialise disk index
2520 DISKNDX = 0
2530 REM
2600 REM Disk Tests:
2610 REM Append different numbers of records to 4
     different length files
2620 REM  Then do reads and writes to a random
     access file
2630 REM
2640 REM Generate 20 random numbers totalling the
     calibration number
2650 X$ = "XxXxXxXxXxXxXxXxXxXXxxXXxxXXxxXXxxXX
     xxXXxxXXxxXXxxXxXxXxXxXxXxX"
2690 REMAIN% = ITERATE*SLOWDN
2700 DIM ARR%(20)
2710 FOR I% = 1 TO 19
2720     ARR%(I%) = INT(RND*(REMAIN%/(20-5I)))
2730     REMAIN% = REMAIN% - ARR%(I%)
2740 NEXT I%
2750 ARR%(20) = REMAIN%
2760 REM Now do the actual test
2770 START = TIMER
2780 FOR I% = 1 TO 4
2790     FILENAM$ = "FILENAM"+CHR$(48+I%)
2800     OPEN "A",1,FILENAM$
2810     FOR J% = 1 TO 5
2820         FOR K% = 1 TO ARR%((I%-1)*5 + J%)
2830             WRITE#1,X$
2840         NEXT K%
2850     NEXT J%
2860 CLOSE #1
2870 NEXT I%
2880 MID = TIMER
2890 FOR I% = 1 TO 4
2900     FILENAM$ = "FILENAM"+CHR$(48+I%)
2910     OPEN "A",1,FILENAM$
2920     FOR J% = 1 TO 5
2930         FOR K% = 1 TO ARR%((I%-)*5 + J%)
2940             Y$ = X$
2950         NEXT K%
2960     NEXT J%
2970 CLOSE #1
2980 NEXT I%
2990 FINISH = TIMER
3000 DISKSEQ = (2*MID - FINISH -
     START)/(ITERATE*SLOWDN/6400)
3010 PRINT "sequential disk access rated ";DISKSEQ
3030 REM Do random disk accesses on file of 2000
     46byte records
```

```
3040 REM  Test does 3 reads for every write,
     butterflying over disk
3050 REM Number of iterations is reduced by a
     factor of 10
3060 OPEN "R",#1","randtest.dat",46
3070 FIELD #1,40 AS A$,2 AS B$,3 AS C$
3080 REM Begin loop doing three reads for every
     write
3090 H% = ITERATE*SLOWDN/4000 + 1
3100 START = TIMER
3110 FOR I% = 1 TO H%
3120     FOR K = 6 TO 900 STEP 6
3130         FOR L=1000-K TO 1000+K STEP 2*K
3140             GET #1,L
3150         NEXT L
3160     NEXT K
3170     FOR K = 20 TO 980 STEP 20
3180         FOR L=1000-K TO 1000+K STEP 2*K
3190             PUT #1,L
3200         NEXT L
3210     NEXT K
3220 NEXT I%
3230 MID = TIMER
3240 FOR I% = 1 TO H%
3250     FOR K = 6 TO 900 STEP 6
3260         FOR L=1000-K TO 1000+K STEP 2*K
3270             A$=A$:B$=B$:C$=C$
3280         NEXT L
3290     NEXT K
3300     FOR K = 20 TO 980 STEP 20
3310         FOR L=1000-K TO 1000+K STEP 2*K
3320             A$=A$:B$=B$:C$=C$
3330         NEXT L
3340     NEXT K
3350 NEXT I%
3360 FINISH = TIMER
3370 CLOSE #1
3380 DISKRAND = (2*MID - FINISH - START)/H%
3390 DISKNDX = SQR(DISKSEQ*DISKRAND)*RATIO
9990 OPEN"o",1,bnchmark.dat"
10010 WRITE#1,CNAME$,PNAME$,PSPEED,DNAME$,
     DCAPAC$,DSPEED$,MCHIP$,MSPEED$,MCAPAC,
     MEMNDX%,VNAME$,VCAPAC$,PRICE,PRICENDX,
     XSLOTS,XSLOTNDX,FTPRT,FTPRTNDX,USABIL,
     REASON$,ITERATE,SLOWDN%,RATIO,CLRSCR,
     CURSOR,SCROLL,GRAPH,VIDEONDX,DISKSEQ,
     DISKRAND,DISKNDX
10020 CLOSE#1
10030 SYSTEM                           ends
```

Finally, price. We set the mid-price of a machine at $6000, the best price at $1000, and the worst at $31,000. This gives a function with two linear parts — 5+(6000–price)/1000 for prices less than or equal to $6000, and 5+(6000–price)/5000 for prices greater than $6000.

Having calculated these indices, how do you combine them into one meaningful figure? We decided that the machine's worst limitation (ie, the lowest of the four usability indices) should set the overall figure — so we took the minimum of the four as the final result. This minimum figure should always be accompanied by the name of the minimum index. An example should make this clearer. Let's work out the index for two machines: one good, the other with a major problem — a lack of slots.

	Machine A	Machine B
No of slots	5	2
Footprint	40x40 + 55x10	42x39 + 57x10
Memory	640k	1Mbyte
Price	$3440	$3220
Slot index	6	3
Footprint index	7	7
Memory index	5	6
Price index	7	7
Overall index	5 (memory)	3 (slots)

These figures say that machine A is average (usability index 5), and that its worst feature is its average memory. Machine B, however, has an index of three due to lack of available slots.

So at a glance you can see what the machine's worst feature is and how badly it affects the machine's usability.

The crystal ball

The usability index can be improved. It would ideally include a noise level factor that would combine background noise, usually made by the fan, and in-use noise during heavy disk access.

You could also test keyboard clatter, but obviously it is virtually impossible to test consistently.

Any interested parties wishing to donate a keyboard clatter generating machine are most welcome. The said machine must be able to press a fixed pattern of keys with reliable and repeatable intensity without generating an overpowering noise itself.

Unfortunately, accurate noise testing is an expensive art and a time-consuming process, so we have not included it in this set of results. Other factors which could

be built in include availability of software and strength of backup support.

The number of packages available for MS-DOS machines is probably the biggest point in these computers' favour. A software availability index should rate them highly in this area and penalise specialist machines only designed to perform CAD functions or point-of-sale operations.

The customer support that IBM offers and the large catalogue of replacement parts is the reason why no-one has ever been sacked for buying an IBM. A support index should take into account warranty period and attempt to remove points from companies that import off-the-shelf bits and pieces and have a 'switched-on high school student' stringing them together.

We have already alluded to the problems of testing reliability and the need for a multi-user performance rating. Of the two, the multi-user rating is probably more urgent. The difficulty is that multi-user environments should be tuned to the particular configuration employed. Developing a test using a standard configuration would be ridiculously arbitrary. Testing a range of configurations seems prohibitively complex.

A number of solutions has been suggested, from carrying around two portables performing terminal emulation, to inventing a black box that can pretend to be a whole office doing multiple functions at once.

While we do not currently have solutions to these problems, we are serious about these benchtests. The tests that we have developed and used for the first time in this, *APC's* 100th issue, are an attempt to measure performance as it relates to the average user.

Standards Australia has been encouraging. As the official body formulating standards in Australia, it clearly sees the need for a means of testing which both consumers and the industry can trust. We look forward to working further with Standards Australia and other interested persons or organisations to establish a recognised and meaningful suite of tests.

END

Phil Cohen is a director of Hard Copy, a Sydney technical writing company.

APC's monthly pot-pourri of hardware and software productivity tips. APC will pay between $100 and $200 for each tip published. Write to TJ's Workshop, APC, 124 Castlereagh Street, Sydney 2000.

MacGolf 3.0

If you have Pyro! on your hard disk and accidentally move the cursor to the sleep corner of the screen while playing MacGolf, the screen will black out as usual, but when it comes back on, you'll be faced with a blank screen except for the menu bar.

There is a way, however, to restore the various windows of the game without resetting and starting from scratch.

To restore the Map window on the right side of the screen, first pull down the Options menu and select one of the five View Enlargements that wasn't selected prior to the blackout.

To restore the Golfer in the main window, pull down the Club menu and select a new golf club.

Finally, to restore the background scenery, click the Turn Left or Turn Right button and then the View button.

You're all set — just yell 'Fore!'
R Narusaki

MacPaint

Printing from MacPaint to a LaserWriter is incredibly slow with the new version (2.0). I've found I can save quite a bit of time by copying the entire screen to the Clipboard, quitting MacPaint, opening Word (or if you're using MultiFinder, switching to Word), pasting the picture into a new document, and printing it from there.
A Magnori

Customising Mac Excel

Some of the new features in Microsoft Excel 1.5 make it easy to customise, even though there is no Preferences command. I, for example, have a macro sheet that contains all my most commonly used macros. I keep this macro sheet on the top level of my directory and put the actual Excel program in a folder. When I want to start Excel, I simply open this macro sheet. It contains an AUTOEXEC macro that performs the customisation I require upon startup. This way, the blank worksheet waiting for me is in my favourite font, Palatino 12 point, and the pages will print without grid lines or column heads and with a date stamp instead of a page number. Also, the grid lines are turned off on the display. In addition, a few of my common macros are entered into a couple of custom menus labelled A and B.

By starting a session this way — via the macro sheet and not by double-click-ing the application icon — not only do I have a customised startup, but I always have my most common macros available to me.
L McArthy

HyperCard sorting fix

A simple addition to the script of the Sort button in the Address stack will allow names followed by academic degrees or 'Jr.' or 'Sr.' to sort correctly by last name when using the 'Last
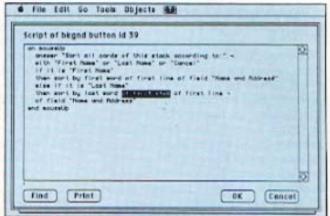
Fig 1 The address stack that accompanies Hyper-Card does not sort by last names correctly when they include titles like 'Dr.' 'Sr.' or 'Ph.D'. By adding the highlighted words to the script of button ID 39, this problem can be avoided

Name' option on the button. As written, this option causes cards containing the mentioned titles to sort by the title rather than the surname. HyperCard recognises groups of words separated by a comma as an item. Correct usage calls for a comma after the last name and before the added title. Therefore adding the phrase 'of first item' into the script as indicated in Fig 1 results in a correct sort for names either with or without a title.
R Sheavly

Cleaning up screen shots

When you need to isolate an icon or dialogue box in a screen shot to include in a document (see Fig 2a), it's a royal pain to trim off the background grey pattern (usually you have to resort to fat bits to get it exact). Here's a simple way to make editing screen shots easier. Use the Control Panel to change the desktop pattern to white (click on the upper-left arrow until the pattern shows completely white, as in Fig 2b, then click in the tiny window below the arrow to apply the change). Most applications actually use the desktop pattern as their own background pattern, so this change makes screen shots within applications easier too. Now when you take a screen shot (using Command-Shift-3), the screen item you need will be easy to select or lasso all by its lonesome (see Fig 2c).
A Muezza

Keeping path statements short

I like to keep my path as short as possible to minimise directory searches and disk activity. In order to maintain a minimum path, I start programs with batch files that save the current path, change the path to that required by my application, start the application, and then restore the original path. The file SAVEPATH.BAT, shown in Fig 3, is an efficient way to do this. The second line stores the current path in the 'oldpath' environment variable. Lines three and four set up the new path and invoke my application. Lines five and six restore the original path and remove 'oldpath' from the environment.
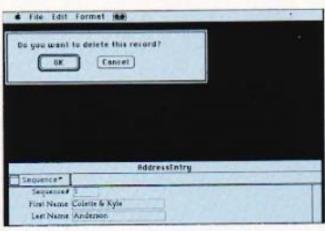
If you keep the external DOS command programs in C:\DOS and batch files in C:\BAT, the path you set in your AUTOEXEC can be as simple as PATH = C:\DOS;C:\BAT. This can greatly reduce the number of directories and filenames that DOS must search to start an application.
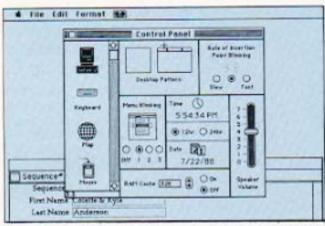
It is a good idea to minimise the use of the APPEND command because of its side effects (see TJ's Workshop, July 1988). However, a minimum APPEND path can also reduce directory searches and disk activity. In order to accomplish this, I start programs requiring an APPEND path with a batch file that saves the old APPEND path, changes it to one appropriate for my application, executes the application, and restores the original APPEND path. The file SAVEAPP.BAT shown in Fig 4 demonstrates how this can be accomplished.
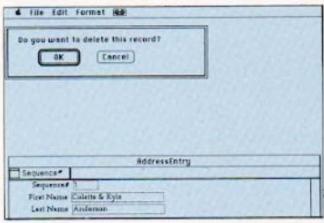
SAVEAPP.BAT works in the following manner. In line two, APPEND with no arguments echoes the APPEND path. If there is none, it echoes 'No Append'. FIND /V filters out the 'No Append' line, so APATH.BAT contains either an APPEND = command or nothing. Line three sets up the appropriate new APPEND path, and line four invokes my application. Line five clears the APPEND path, and line six runs APATH.BAT. If there were a prior APPEND path, the APATH.BAT file restores it; if not, it does nothing.
C Finley

APPEND is a Band-Aid for programs that don't support subdirectories. When you absolutely must use it, the method described here will protect you from its side effects. Note that lines two and six in SAVEAPP.BAT save and restore the previous APPEND path. The safest practice is to have no APPEND path except when it's needed — if you do that you can omit these lines.

SAVEPATH.BAT wipes out your existing path and replaces it with one specific to the application. Sometimes you may want to keep the existing path and just add another directory to it temporarily. For example, if your application allows you to shell to DOS, you'll want your DOS programs and batch files to be accessible. In that case, just change the third line of SAVEPATH.BAT to

Figs 2a, b and c. Tidying up screen dumps for inclusion in documents can be messy. Clean up your act by learning the ins and outs of the Control Panel. a) shows the typical screen prior to the fateful Command-Shift-3. b) enlightens you to the necessary settings on the Control Panel. c) makes it all whiter than white

```
PATH C:\MYAPP;%PATH%
```

As before, the final lines restore the original path and clear the environment variable 'oldpath' — NR.

Unprotect Basic files

I discovered a method to remove protection from Basic programs written in IBM Basic. I use it because I like to see their

listings to learn new things. The first step is to type and run this short program:

```
10 DEF SEG
20 BSAVE "UNPROBAS",1124,1
RUN
```

LOAD the program you want to un-protect, and then BLOAD the file UN-PROBAS. That unprotects the file. Now LIST the program to see its contents, or SAVE it unprotected.
H Ali

Every now and then, this tip comes up again; it's a shame they don't just put it in the manual. When you save a Basic file with the P option, it sets a flag in the program's header that tells Basic not to LIST or SAVE the program. BLOADING the UNPROBAS file overwrites that flag. Note that once you've created UN-PROBAS, you can just store it with your Basic files and use it as needed.

Here are the exact instructions to type into the Basic interpreter if you want to unprotect a file called SECRET.BAS:

```
LOAD"SECRET
BLOAD"UNPROBAS
```

```
SAVE"SECRET
```

That does it — BW.

Accenting paragraphs

The following sequence of PostScript commands will accent a paragraph with a background screen in Mac Word:

```
.para. gsave .97 setgray
wp$box fill grestore
```

The grey intensity is set to .97 (where 1 represents white and 0 black). The space above and below the paragraph (as set in the Paragraph menu) is included in the shaded region and this background screen resizes itself if the paragraph is edited.
D Sarwate

Detecting a DOS shell

Many programs provide the ability to exit temporarily to a secondary copy of COMMAND.COM. Although there is usually an initial indication that you are in a secondary command shell, it quick-ly scrolls off the screen.

One solution I have found is to invoke

```
ECHO OFF
SET OLDPATH=%PATH%
PATH C:\MYAPP
MYAPP %1
PATH %OLDPATH%
SET OLDPATH=
```

Fig 3 This batch file sets up an applica-tion-specific path, then restores the original path

```
ECHO OFF
APPEND | FIND /V "No Append" > C:\APATH.BAT
APPEND C:\MYAP\MYDATA
C:\MYAP\MYAP
APPEND |
C:\APATH.BAT
```

Fig 4 A batch file that protects you from the side effects of the APPEND com-mand

such programs with a batch file that in-cludes the following commands:

```
SET PROM=%PROMPT%
SET PROMPT=[%0]%PROMPT%
{other commands to invoke
program}
SET PROMPT=%PROM%
```

The first two SET commands save the current value of the DOS prompt in the environment variable 'prom' and prefix the prompt with the name of the batch file. The last SET command restores the prompt to its original setting. Now if I use the DOS shell facility of the program invoked by the batch file, I have a clear indication that this is not the primary copy of COMMAND.COM.

The batch file SETPROMP.BAT shown in Fig 5 demonstrates this technique. This batch file invokes a secondary copy of COMMAND.COM, which will remain the active command processor until it receives an EXIT command. Until the secondary COMMAND.COM exits, the DOS prompt will be prefixed with [SETPROMP] (assuming you name the batch file SETPROMP.BAT). When you EXIT the secondary shell, the prompt will return to its normal assignment.
M Reibstein

It's easy to forget that you're running in a shell — it looks just like DOS. Some programs (WordPerfect, for example) already provide a reminder, but for those that don't, this is a nice solution. If you prefer, you can include a more explicit message than the bracketed batch file

```
ECHO OFF
SET PROM=%PROMPT%
SET PROMPT=[%0]%PROMPT%
ECHO EXIT to return to the primary COMMAND.COM
COMMAND
SET PROMPT=%PROM%
SET PROM=
```

Fig 5 This batch file demonstrates how the prompt can remind you that you're running in a secondary command processor

name. For example, replace the third line of SETPROMP.BAT with

```
SET PROMPT=[EXIT to
return]%PROMPT%
```

Try running SETPROMP.BAT several times in a row. Each time you run it you invoke another secondary COMMAND.COM, and each time your prompt grows. To get back to the main command processor, just keep entering EXIT until your prompt returns to normal — NR.

Grabbing italics on a Mac screen

Setting the insertion point and selecting individual letters can be difficult and inexact when working with italics — partly because the insertion point is vertical and italic letters are not and also because italic screen fonts are usually terrible. Here is a simple way to set the insertion point and select individual letters consistently — no more hit and miss:
1. Move the I-beam to the *centre* of the letter *just in front* of the letter that you want to select.
2. Click. The insertion point will be set immediately in front of the desired letter.

That's it. Now you can be certain that any typing at this point will be placed where you want it. You can also easily drag from the insertion point to the right and always select the desired letter. Select the first letter of a line of italics by

clicking well to the left of the line and dragging to the right until a selection 'pops' up on the screen.
P Gaines

More Turbo Pascal lines and columns

There are some situations in which the standard IBM PC video screen (80 by 25) is not big enough to display all the information we want to show on a single screen — for example, when you need to display a summary table, a correlation matrix, etc. In those situations, you may wish you could have a monitor that can display 150 columns and 40 or 50 lines.

One way out of this limitation is to create a virtual screen. The virtual screen can hold all the information you want and at any time display a part of it on the video monitor. Your screen just becomes a 'viewport' into the virtual screen that you can drag around using the arrow keys, as shown in Fig 6. The program listing in Fig 7 provides the basic procedures to do just that.

The Big_ClrScr routine is similar to the Turbo Pascal built-in function ClrScr. It clears the entire virtual screen (not the

Display screen as Viewport

Monitor Screen

Big Screen
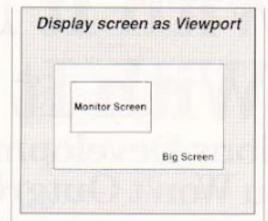
Fig 6 A visual representation of the video monitor as a viewport into a larger virtual screen

monitor screen). The Big_Write procedure puts the text given in the first parameter on the virtual screen. The three next parameters specify the position on the screen (Col, Row) and the video attribute of the text (VidAtt). The Show_BigScreen routine moves a part of the virtual screen on the video monitor. The two parameters specify the upper-left corner of the window on the virtual screen. This procedure is called by the GetMove procedure that waits for

a key from the keyboard. If you press an arrow key, the viewport moves in that direction.
N Peladeau

Be warned — this program will cause ugly 'snow' on a standard IBM CGA. Accessing the video RAM directly while the electron beam is writing to the screen causes this snow. If you adopt this technique, you will need a procedure to access video RAM during the retrace interval, when the electron beam is sweeping back for the next scan line. Almost every library of Turbo Pascal routines includes such a procedure. In addition, the procedure Show_BigScr checks the video mode by directly examining a byte in the BIOS data area. This technique generally works, but it is safer for you to simply query the video interrupt, as in the program listing VIDMODE.PAS that is shown in Fig 9.

Cursor shapes in Turbo Pascal

Many programs that modify the cursor will return the cursor as a dash instead of an underline when run on a monochrome system. This happens

```
PROGRAM Bigger Screen;
USES CRT, TURBO3;
(* NOTE: Delete the line above for use in Turbo Pascal 3.0. The
   program works as is in TP4. *)
CONST
   Wide = 150;   { You can adjust the size of the virtual screen  }
   Long = 40;    { by changing these two constants                }
   Nline = 25;   { change to 24 if your monitor displays only 24 lines }

TYPE
   Scr = ARRAY[1..Nline, 1..80, 1..2] OF Char;
   Longstring = STRING[255];

VAR
   MonoS : Scr ABSOLUTE $B000 : $0000;
   ColoS : Scr ABSOLUTE $B800 : $0000;
   Mode  : Byte ABSOLUTE $0040 : $0049; { video mode }
   BigScr : ARRAY[1..Long, 1..Wide, 1..2] OF Char;

   PROCEDURE Big_ClrScr;
   VAR I : Integer;
   BEGIN
      FOR I := 1 TO Wide DO
         BEGIN
            BigScr[1, I, 1] := Chr(32);
            BigScr[1, I, 2] := Chr(15);
         END;
      FOR I := 2 TO Long DO Move(BigScr[1, 1, 1], BigScr[I, 1, 1], Wide*2);
   END;

   PROCEDURE Big_Write(Line : Longstring; Col, Row : Integer; VidAtt : Byte);
   VAR I : Integer;
   BEGIN
      IF (Row <= Long) THEN
         FOR I := 0 TO Length(Line)-1 DO
            IF (Col+i) <= Wide THEN
               BEGIN
                  BigScr[Row, Col+i, 1] := Line[i+1];
                  BigScr[Row, Col+i, 2] := Chr(VidAtt);
               END;
   END;

   PROCEDURE Show BigScr(col, Row : Integer);
   VAR I : Integer;
   BEGIN
      FOR I := 1 TO Nline DO
```

```
CASE Mode OF
   7    : Move(BigScr[i+col-1, row, 1], MonoS[I, 1, 1], 160);
   2, 3 : Move(BigScr[i+col-1, row, 1], ColoS[I, 1, 1], 160);
END;
END;

PROCEDURE GetMore;
VAR
   Ch1, Ch2 : Char;
   PosX, PosY : Integer;
BEGIN
   PosX := 1; PosY := 1;
   ClrScr;
   REPEAT
      Show BigScr(PosX, PosY);
      Read(Kbd, Ch1);
      IF Ch1 = Chr(27) THEN
         BEGIN
            Read(Kbd, Ch2);
            CASE Ord(ch2) OF
               72 : IF PosY > 1 THEN PosY := Pred(PosY);         {up   }
               77 : IF PosX < Wide-79 THEN PosX := Succ(PosX);   {right}
               80 : IF PosY < Long-Pred(Nline) THEN
                       PosX := Succ(PosY)                        {down }
               75 : IF PosX > 1 THEN PosX := Pred(PosX);         {left }
            END;
         END;
   UNTIL Ch1 = Chr(13);
END;

BEGIN
   Big_ClrScr;
   Big_Write('<- this is the upper left corner of the screen',
      1, 1, White);
   Big_Write('Use arrow keys to move the "viewport"; press <Return> to quit',
      1, 2, White);
   Big_Write('<- this is the middle of the screen',
      Wide DIV 2, Long DIV 2, Red);
   Big_Write('this is the lower right corner of the screen ->',
      Wide-46, Long, 25);
   GetMore;
END.
```

Fig 7 A program demonstrating a virtual screen larger than the monitor

```
(SR+)                                        WriteLn('Use 2 numeric parameters (to set ',
PROGRAM Cursor;                               'cursor top and bottom, e.g. "Cursor 2 10").');
VAR                                          END;
  I, J, X : Integer;                      2 : BEGIN
  Equipment_Flag : Integer ABSOLUTE $40:$10;    Val(ParamStr(1), I, X);
                                                IF X <> 0 THEN
  PROCEDURE Set_Cursor(Top, Bottom : Byte);       BEGIN
  TYPE                                              Write('Parameters must be numeric! ');
    Registers = Record                             WriteLn(ParamStr(1),'" is not.');
      CASE Integer Of                              Halt;
        1 : ( AX,BX,CX,DX,BP,SI,DI,DS,ES,Flags : Integer );   END;
        2 : ( AL,AH,BL,BH,CL,CH,DL,DH : Byte );    Val(ParamStr(2), J, X);
    END;                                         IF X <> 0 THEN
  VAR                                              BEGIN
    recpack : Registers;                             Write('Parameters must be numeric! ');
  BEGIN                                              WriteLn(ParamStr(2),'" is not.');
    Recpack.AH := 1;                                 Halt;
    RecPack.CH := Top;                             END;
    RecPack.CL := Bottom;                          Set_Cursor(I, J);
    Intr($10, recpack);      (call interrupt)    END;
  END;                       { Set_Cursor }    ELSE
                                                 BEGIN
BEGIN                                             WriteLn('Call program either with no ',
  CASE ParamCount OF                              'parameters (for reset to MONO startup cursor)');
    0 : IF Equipment_Flag AND $30 = $30 THEN { Monochrome board? }   WriteLn('or with 2 numeric parameters (to set ',
        Set_Cursor(11, 12)                        'cursor top and bottom, e.g. "Cursor 2 10").');
      ELSE                                       END;
        BEGIN                                  END; (CASE)
          WriteLn('Auto-reset is for MONO system only.');   END.
```

Fig 8 The program CURSOR.PAS lets you set the cursor shape in Turbo Pascal

when the program saves the original cursor shape and resets it to that shape when it's done.

A simple solution to this problem is to set the cursor manually before running any cursor-modifying programs. Doing so also corrects the cursor scan line numbers that are stored in memory. The program shown in Fig 8 does just this if run with no parameters. It first checks to see that a monochrome board is in use. You can include the program in your AUTOEXEC.BAT file if you like. If you call it with two parameters, it will set the cursor's top scan line to the first and the bottom to the second. Creative parameter juggling can yield cursors that look like blocks, underbars, or even double blocks. You can change the cursor to let the user know what is going on, for example, whether he is in insert or overwrite mode. (Note: Fig 8 was written in Turbo Pascal 3.0. To convert it to 4.0, use the compiler's UPGRADE.EXE

utility.) One interesting quirk I've discovered is that while many parameter sets simply yield no cursor, others such as

CURSOR 100 105

give a cursor that looks normal but blinks very slowly.
E Woodhouse

The parameter set

CURSOR 0 12

would set a full block on a monochrome monitor. For a CGA, you'd use

CURSOR 6 7

The slow-blinking or erratic cursor is a phenomenon of the monochrome monitor only. Note that this program uses a somewhat chancy method of

checking the current video mode. It looks at the BIOS Equipment Flag for the monitor currently in use. In general, you should query the video interrupt to get the current mode, as in the listing VIDMODE.PAS in Fig 9 — NR.

Turbo Pascal RAM size check

It can be handy for your program to know how much memory its host computer has. When an application may run on a variety of different hardware, you can use this information to set up a balance of memory and disk-based storage. The function MemSize included in Fig 10, which was written in Turbo Pascal 3.0, calls interrupt $12 to get that information. The number returned by MemSize is the amount of memory installed in the system, not the amount of free RAM.
Kevin King

```
(SR+)                                        END;              (* VideoMode *)
PROGRAM VidModeDemo;
VAR                                          BEGIN
  VidMode : Byte;                              VidMode := VideoMode;
                                               IF VidMode = 7 THEN
  FUNCTION VideoMode : Byte;                     WriteLn('Using MONOCHROME monitor, 80x25 TEXT mode')
  CONST                                        ELSE
    BiosVidSvc = $10;     (* Bios Video Services Interrupt *)   BEGIN
    GetVidMode = $0F;     (* Bios Request for Get Video Mode *)   Write('Using Color/Graphics monitor, ');
  TYPE                                             CASE VidMode OF
    RegRec = RECORD                                  0 : WriteLn('40x25 black-and-white TEXT mode');
              AX, BX, CX, DX : Integer;             1 : WriteLn('40x25 color TEXT mode');
              BP, SI, DI     : Integer;             2 : WriteLn('80x25 black-and-white TEXT mode');
              DS, ES, Flags  : Integer;             3 : WriteLn('80x25 color TEXT mode');
             END;                                   4..6 : WriteLn('CGA graphics mode ',VidMode);
  VAR                                              7..10 : WriteLn('PCjr graphics mode ',VidMode);
    Registers : RegRec;                           11,12 : WriteLn('UNKNOWN graphics mode ',VidMode);
  BEGIN                                           13..16 : WriteLn('EGA graphics mode ',VidMode);
    Registers.AX := GetVidMode SHL 8;             END;
    Intr(BiosVidSvc, Registers);              END;
    VideoMode := Lo(registers.AX)             END.
```

Fig 9 The program listing for VIDMODE.PAS is a routine to check the current video mode

```
{$R+}
PROGRAM MemSizeTest;

  FUNCTION MemSize : Integer;
  TYPE
    Regs = RECORD
             AX,BX,CX,DX,BP,SI,DI,DS,ES,Flags : Integer;
           END;
  VAR Registers : regs;
  BEGIN
    Intr($12, Registers);
    MemSize := Registers.AX;
  END;

  FUNCTION KAvail : Integer;
```

```
{ We multiply the high and low bytes of MemAvail }
{ separately in order to avoid problems when its }
{ value is > 32767.  Turbo will treat an integer }
{ > 32767 as a negative number, but bytes are     }
{ always positive.                                }
BEGIN
  KAvail := Trunc((Hi(MemAvail)*256.0+Lo(MemAvail))/64.0);
END;

BEGIN
  WriteLn('TOTAL RAM installed is ', MemSize, 'K.');
  WriteLn('TOTAL RAM available within this program is ', KAvail, 'K.');
END.
```

Fig 10 A program that checks the TOTAL amount of installed RAM

Turbo's own MemAvail function tells how many 16-byte paragraphs of RAM your program can use beyond its basic code and data requirements. If your program needs a lot of RAM, you can check what's available with a function like KAvail in Fig 10.

Using MemSize, you can deliver an intelligent message if KAvail shows too little RAM: for example, 'This program needs 400k to run. You have 640k installed, but only 200k of it is available to me. Please remove some RAM-resident programs and try again'. (Note: In order to convert Fig 10 to Turbo Pascal 4.0, use the compiler's UPGRADE.EXE utility.) — NR.

Red Ryder

In the commercial versions of Red Ryder (10.0 and later), Scott Watson chose not to document a useful feature that was sketchily documented in the 9.0 Read-me file. This feature concerns how to include your own icon in your own menu. You do this in conjunction with the ADD TO MENU procedure command. To do this, you use a caret (^) character after the command, followed by a number. There are two steps involved:
1. Create an icon in a copy of the Red Ryder application using ResEdit. The icon should be an ICON resource and

should have an ID number 265 or higher. Close ResEdit and save your changes.
2. Include a line like this in your procedure file:

```
ADD TO MENU ^9GEnie log-on<S
```

See Fig 12 for an entire procedure file. Refer to the Red Ryder manual for information on how to create a menu and how to use the ADD TO MENU command.

In this example, ^9 stands for the icon with ID number 265. Menu icons are numbered starting with 257, which means ^1 refers to the icon with ID num-

TJ'S WORKSHOP

ber 257, ^2 refers to 258. Things get even weirder when you get past ^9. You can't enter ^10 because there must be a single digit after the caret. Instead, you have to follow the ASCII character set, where the colon (:) follows the character 9. So if you create an icon with ID number 266, you would enter ^: to refer to it.

That's it! Now when you run your procedure, Red Ryder inserts the icon you created to the left of the menu item (see Fig 13).
D Valiulis

QuickBASIC alert

There's a particularly nasty bug in QuickBASIC 3.0 that causes some programs to crash. If a program calls assembler routines and it is compiled to a BCOM file from within the editor, a faulty .OBJ module will be created. One solution is to always compile from DOS, but the best move is to trade up to QuickBASIC 4.0.

Underline fix

The Underline style in Mac Word results in an underline that clings too closely to the word — the line slices right through any descenders. Sometimes the word and underline begin to resemble black scrambled threads rather than emphasised text. Here's how to unscramble this mess, using Word's formula mode.

Select Show ¶ from the Edit menu. Press Command-Option-\ to enter formula mode. Type an O to select the overstrike command, an opening parenthesis, the words to be underlined, a comma, a number of spaces equivalent to the length of your text, and then a closing parenthesis. It should now look like this on screen:

```
\O (peppery pungen-
cy, . . . . . . . . . . . . .)
```

Now select all the spaces following the

Fig 11 Customised menus with user-created icons can be created in Red Ryder — a feature not mentioned in the documentation of the commercial version. Here an icon is forged in ResEdit and added to Red Ryder
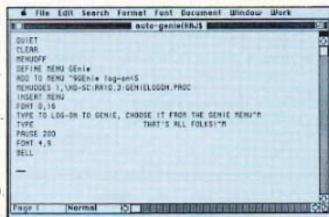
Fig 12 A sample procedure file in Red Ryder showing how the icon is added
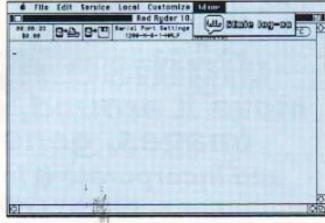
Fig 13 Hello there! Your icon greets you when the menu is pulled down

comma and choose Character from the Format menu. Click Underline and Subscript. Type in the number of points you want the underline subscripted. You'll have to experiment, since the ideal amount differs from font to font and depends on the point size of the text.

```
 File  Edit  Search  Format  Font  Document  Window  Work
```

Untitled1

peppery pungency

peppery pungency

Page 1   Normal

Fig 14 *The underline style in most word processors is less than ideal in appearance. Word's formula mode provides a workaround. The top words are underlined using the usual command from the Format menu. The lower words are underlined in formula mode*

Click OK and select Hide ¶ from the Edit menu. The formula coding will vanish and your underlined word or words will appear. See Fig 14 for examples.

The subscripting might change the leading (line spacing) of the line with the underlined text. To avoid this, enter a specific number for line spacing in the Paragraph dialogue box rather than the usual Auto. If the problem persists, insert a minus sign in front of the line-spacing number. This forces Word to keep the leading at the indicated amount no matter what.

You should save a sample like this to Word's glossary. Then when you want to use this alternative to the inferior underline style on the Format menu, just insert it and substitute new text and the appropriate number of spaces.

V Swanson

Enhance your DOS environment

The earliest computer monitors were little more than electronic teletype machines. And, just like a teletype, they'd print one character at a time until the end of the line, then advance to the start of the next line. In this age of pop-up windows and pull-down menus, that teletype action seems primitive, but it's the way most DOS commands and many utilities work.

Later video terminals added control codes. These codes move the cursor, erase areas of the screen, and generally control the display. You can add this kind of control to your batch files and DOS environment using ANSI.SYS.

Before you try to install ANSI.SYS, make sure it is in the root directory of your boot disk. Then add this line to your CONFIG.SYS file:

`DEVICE = ANSI.SYS`

Now reboot your computer. You won't

notice any immediate difference, but ANSI.SYS is at your command.

To send ANSI.SYS a message, you write an escape sequence to standard output. An escape sequence is a coded string of characters beginning with ASCII character 27, the Esc character. Here we run into a problem: it's difficult to ECHO the Esc character. Yet, to experiment with ANSI.SYS you need an easy way to send it messages. To this end I'm providing ANSI.COM. This tiny program accepts a character string on its command line, replaces every tilde (~) character with an Esc, and writes it to standard output. For example,

```
ANSI ~[2J         clears the
screen
ANSI ~[H          homes the
cursor
ANSI ~[41;33;1m   sets yellow
text
on red background
```

To create ANSI.COM, type in ANSI.SCR as shown in Fig 15 using any editor that can generate flat ASCII files. Make sure you include the blank lines after the RET instruction and after the final Q. With DEBUG.COM in the current directory or available on the path, give the command

`DEBUG < ANSI.SCR`

Watch the output — if you see '^ Error' pointing to a line, double-check that line in ANSI.SCR, fix it, and repeat. Try your

```
N ANSI.COM
A 100
MOV     SI,0082
MOV     CL,[SI-02]
JCXZ    0117
DEC     CX
LODSB
CMP     AL,7E
JNZ     0110
MOV     AL,1B
XCHG    DX,AX
MOV     AH,02
INT     21
LOOP    0109
RET

RCX
18
W
Q
```

Fig 15 *This DEBUG script generates ANSI.COM, a tool to communicate with ANSI.SYS*

ANSI Colour Commands

Parameter	Effect
0	All off (low-intensity white on black)
1	High intensity
4	Underline on (monochrome only)
5	Blink on
7	Reverse video
8	Invisible

Colour	Foreground	Background
Black	30	40
Red	31	41
Green	32	42
Yellow	33	43
Blue	34	44
Magenta	35	45
Cyan	36	46
White	37	47

Fig 16 *ANSI colour commands take the form ESC[#; . . .;#m, where each # represents a number from the list above*

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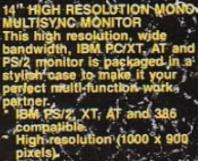
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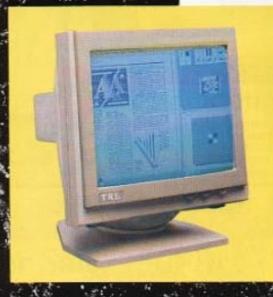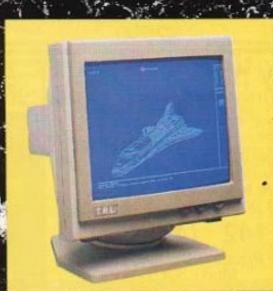
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ANSI Cursor Commands

Cursor direction	Code
Backward	ESC[#D
Forward	ESC[#C
Down	ESC[#B
Up	ESC[#A
To row/column	ESC[#;#H
To row/column	ESC[#;#f
Clear screen	ESC[2J
Erase to EOL	ESC[K
Save cursor position	ESC[s
Restore saved position	ESC[u

Fig 17 The # symbol represents an optional parameter that determines how many times the command will be repeated. For example, ESC[3C moves the cursor forward three characters. It defaults to 1

new ANSI.COM with the examples above or create your own. You can use any ANSI sequence as long as you replace the Esc with a tilde.

You won't find the ANSI commands in your DOS manual unless you're using an old version of DOS. Figs 16 and 17 provide a brief listing of the handiest commands. ANSIBOX.BAT, shown in Fig 18, demonstrates what you can do with these ANSI commands in a batch file. The first ANSI command prints 'X marks the spot (X)' and saves the current cursor position. The next three commands write a yellow-on-red box with yellow-on-black text inside it. Then the last line comes back to the previous cursor position, turns off all colour attributes, and finishes that line. With ANSI.COM you can beautify all your batch files — NR.

Executing repetitive operations

To perform repeated operations with a single keystroke combination, I created ANSIKEY.BAT shown in Fig 19. To assign a text string to a key combination, enter

```
ANSIKEY F# [text of key set-
ting, up to 8 words].
```

```
ECHO OFF
ANSI X marks the spot (X)~[s
ANSI ~[5;27H~[41;33;1m
ANSI ~[6;27H|~[40m HERE IS TEXT IN A BOX ~[41m|
ANSI ~[7;27H
ANSI ~[u~[0m... and here we are back at the spot.
```

Fig 18 An example of how to use ANSI to beautify batch files

```
ECHO OFF
IF NOT "%9"=="" GOTO TooMany
GOTO %1
GOTO ERROR
:F1
ANSI ~[0;84;"%2 %3 %4 %5 %6 %7 %8";13p
GOTO OK
:F2
ANSI ~[0;85;"%2 %3 %4 %5 %6 %7 %8";13p
GOTO OK
:F3
ANSI ~[0;86;"%2 %3 %4 %5 %6 %7 %8";13p
GOTO OK
:F4
ANSI ~[0;87;"%2 %3 %4 %5 %6 %7 %8";13p
GOTO OK
:F5
ANSI ~[0;88;"%2 %3 %4 %5 %6 %7 %8";13p
GOTO OK
:F6
ANSI ~[0;89;"%2 %3 %4 %5 %6 %7 %8";13p
GOTO OK
:F7
ANSI ~[0;90;"%2 %3 %4 %5 %6 %7 %8";13p
GOTO OK
:F8
ANSI ~[0;91;"%2 %3 %4 %5 %6 %7 %8";13p
GOTO OK
:F9
ANSI ~[0;92;"%2 %3 %4 %5 %6 %7 %8";13p
GOTO OK
:F10
ANSI ~[0;93;"%2 %3 %4 %5 %6 %7 %8";13p
GOTO OK
:TooMany
ECHO.Key setting text can contain at most 8 words.
GOTO DONE
:ERROR
ECHO SYNTAX: "ANSIKEY F# [text of key setting, up to 8 words]"
GOTO DONE
:OK
ECHO %1 %2 %3 %4 %5 %6 %7 %8 > \%1.KEY
:DONE
```

Fig 19 ANSIKEY.BAT makes assigning text strings to keys easy

For example,

```
ANSIKEY F1 CD\DOS\DBASE\DRAW-
INGS
```

will set function key F1 to execute

```
CD\DOS\dBASE\DRAWINGS
```

when you enter Shift-F1.

To store the key settings, I create ten files, F1.KEY through F10.KEY. List the key assignments stored in these files by

using ANSIKEYL.BAT in Fig 20.

The .KEY files must be initialised at startup via ANSIKEYI.BAT, shown in Fig 21, which I execute within AUTOEXEC.BAT.

All three batch files — ANSIKEY.BAT, ANSIKEYL.BAT, and ANSIKEYI.BAT — require that ANSI.SYS be installed. To do this, move ANSI.SYS into your root directory and add this line to your CONFIG.SYS:

```
DEVICE = ANSI.SYS
```

Within ANSIKEY.BAT, I use ANSI.COM to send the appropriate command to ANSI.SYS. For function keys F1 through F10, I send the scan codes 84 through to 93.

This same technique could be used to assign values to other keystroke combinations. I have chosen Shift-F# because it seems to be a key combination that's less used than Alt or Ctrl, for ex-

```
ECHO OFF
ECHO Key assignments for shifted function keys
REM "COPY ... CON > NUL" hides any "File not found" messages.
FOR %%f IN (1 2 3 4 5 6 7 8 9 10) DO COPY \F%%f.KEY CON > NUL
```

Fig 20 ANSIKEYL.BAT lists the current key assignments made by ANSIKEY.BAT

ample. This technique saves me a substantial amount of time, and it uses only standard MS-DOS commands.
P Hayes

The submitted ANSIKEY.BAT file relied on the PROMPT command to send key redefinition strings to ANSI.SYS. As a result, it wiped out the existing prompt. To save the prompt, I fixed AN-SIKEY so it uses the ANSI.COM program instead.

Any command you create with AN-SIKEY will automatically have a carriage return added to it. If you don't want that carriage return, remove the three characters ;13 from each ANSI command line.

ANSIKEY allows you only to assign text strings to shifted function keys. If you'd like to experiment further, you can use ANSI.COM to create other key reassignments. The syntax is

```
ESC[#;#;..#p
ESC[#;"string"p
ESC[#;"string";#;"string"p
```

The first number (#) is the ASCII code of the key you're redefining. If this number is 0, the second number is the extended ASCII code of the key. The remainder of the command is the character sequence you want to assign to that key. This sequence can contain any number of quoted text strings and ASCII character numbers separated by semicolons. For example,

```
ANSI ~[0;84;"DIR *.COM
/W";13;"DIR *.EXE /W";13p
```

will set the Shift-F1 key to do first a wide directory of .COM files and then a wide directory of .EXE files.

ANSI key reassignments work only in programs that use DOS standard input

and output. There aren't many such programs these days, but the DOS command level itself, along with utilities such as DEBUG and EDLIN, are likely places to use them — NR.

Boxing with formulae

How do you put a box within a box in Mac Word 3.0X? The program's formula mode rides to the rescue once again.

Ordinarily you box a paragraph or

```
ECHO OFF
ECHO F1 > \F1.KEY
ECHO F2 > \F2.KEY
ECHO F3 > \F3.KEY
ECHO F4 > \F4.KEY
ECHO F5 > \F5.KEY
ECHO F6 > \F6.KEY
ECHO F7 > \F7.KEY
ECHO F8 > \F8.KEY
ECHO F9 > \F9.KEY
ECHO F10 > \F10.KEY
```

Fig 21 ANSIKEYI.BAT initialises the .KEY files that track the current key assignments

---

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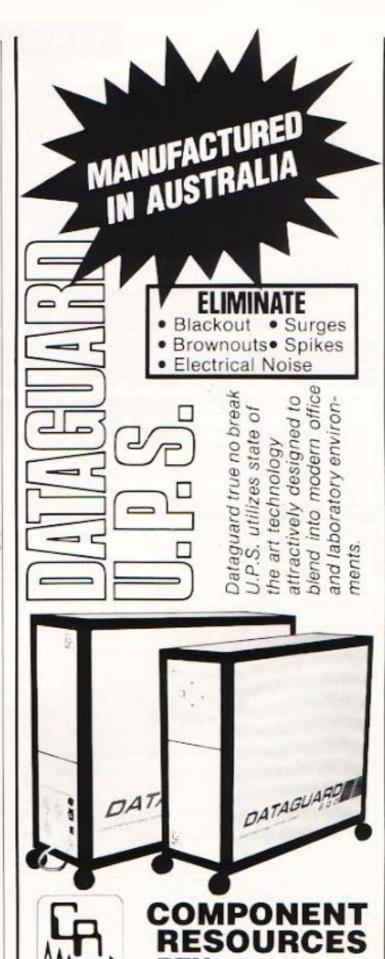
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```
DEF FNGetKey$

    'Works like INKEY$, but also returns a repeat count for extended keys.

    STATIC GetKey$, ScanCode%, Mask%, Count%, InArray%(1), OutArray%(1)
    REDIM InArray%(7), OutArray%(7)

    GetKey$ = INKEY$                        'get a keystroke
    FNGetKey$ = GetKey$                     'set up default return value
    IF LEN(GetKey$) <> 2 THEN EXIT DEF      'if null or normal key, exit

    ScanCode% = ASC(RIGHT$(GetKey$, 1))     'isolate the key's scan code
    Mask% = 8                               'assume it's an Alt-key for now
    Count% = 1                              'assume no repeats for now

    SELECT CASE ScanCode%
        CASE 94 TO 103                      '<Ctrl-F1> through <Ctrl-F10>
            Mask% = 4
        CASE 115 TO 119                     '<Ctrl-Left>, <Ctrl-Right>, <Ctrl-End>,
            Mask% = 4                       '<Ctrl-PgDn>, or <Ctrl-Home>
        CASE 132
            Mask% = 4                       '<Ctrl-PgUp>
        CASE ELSE
    END SELECT

    'Wait for additional keystrokes until the user either releases the
    '<Alt> or <Ctrl> key, or hits a different keystroke.

L1: InArray%(0) = &H200

    'Call the BIOS to get the status of the <ALT> and <CTRL> keys.
    CALL INT86(&H16, VARPTR(InArray%(0)), VARPTR(OutArray%(0)))

    'Check the appropriate bit in the AL register.
    IF (Mask% AND OutArray%(0)) = 0 GOTO Done

    'Call the BIOS to see if there is a keystroke waiting in the buffer.
    InArray%(0) = &H100
    CALL INT86(&H16, VARPTR(InArray%(0)), VARPTR(OutArray%(0)))

    'Check the Z flag in the FLAGS register to see if a keystroke is waiting.
    IF (OutArray%(7) AND 64) = 64 GOTO L1

    'Examine AH register to see if keystroke matches the previous scan code.
    IF PEEK(VARPTR(OutArray%(0)) + 1) <> ScanCode% GOTO Done

    'Remove the keystroke from the keyboard buffer and increment the count.
    GetKey$ = INKEY$
    Count% = Count% + 1
    GOTO L1

Done: IF Count% <> 1 THEN FNGetKey$ = GetKey$ + CHR$(Count%)

END DEF

'Test program for FNGetKey$

L2: Key$ = FNGetKey$
    IF Key$ = "" GOTO L2

    SELECT CASE LEN(Key$)
        CASE 1
            PRINT Key$;
        CASE 2
            PRINT "Scan Code: "; ASC(MID$(Key$, 2))
        CASE 3
            PRINT "Scan Code: "; ASC(MID$(Key$, 2));
            PRINT "Count: "; ASC(RIGHT$(Key$, 1))
    END SELECT
    PRINT
    GOTO L2
```

Fig 22 A QuickBASIC function that distinguishes multiple keystrokes

group of selected paragraphs by selecting Box from the Border selections in the Paragraph dialogue box. Box choices are Single, Thick, Double, or Shadow.

To do a box within a boxed group of paragraphs, first turn Show ¶ on. Press Command-Option-\ and then an X. Type the text to be boxed with parentheses after the X. Then Hide ¶, and an inner box will appear. The nested box is limited to a single line of text, and any return, including soft returns, will cancel

the box formula command.

You can use this feature to create boxed labels within a boxed table. The boxed text can be bold or italicised — any variation normally available from the Format menu or the Character dialogue box.
V Swanson

Multiple keystroke recognition

Programs that use PgUp and PgDn can be improved if you can move by more than one page at a time. This is often done by combining PgUp and PgDn with Ctrl to page in higher, fixed increments.

A better alternative to this is to count the number of times that the keys have been pressed while the Ctrl key is held down. This creates keystrokes such as Ctrl-PgUp-PgUp-PgUp, which can be interpreted to mean 'Page up three pages'. This could also be applied to graphics software that has a zoom

```
PROGRAM Copy;
CONST
  BufSize = 16384;
VAR
  ioCode                : Byte;
  SrcFile, DstFile      : FILE;
  FileNameA, FileNameB  : STRING[255];
  Buffer                : ARRAY[1..BufSize] OF Byte;
  RecsRead              : Integer;
  DiskFull              : Boolean;

PROCEDURE SrcFileError(ioCode : Byte);
BEGIN
  Write(#7, 'I/O result of ', ioCode, ' (decimal) ', #26);
  CASE ioCode OF
    $01 : Writeln(' Source file not found.');
    $F3 : Writeln(' Too many files open.');
    ELSE Writeln(' "Reset" unknown I/O error.');
  END;
END;

PROCEDURE DstFileError(ioCode : Byte);
BEGIN
  Write(#7, 'I/O result of ', ioCode, ' (decimal) ', #26);
  CASE ioCode OF
    $F0 : Writeln(' Disk data area full.');
    $F1 : Writeln(' Disk directory full.');
    $F3 : Writeln(' Too many files open.');
    ELSE Writeln(' "Rewrite" unknown I/O error.');
  END;
END;

BEGIN
  Write('Copy from file : ');
  ReadLn(FileNameA);
  Write('          To file : ');
  ReadLn(FileNameB);
  IF FileNameB <> FileNameA THEN
    BEGIN
      Assign(SrcFile, FileNameA);
      Assign(DstFile, FileNameB);
      (* Note second parameter in "reset" and "rewrite" of UNtyped files. *)
      ($I-) Reset(SrcFile, 1); ($I+)
      ioCode := IOResult;
      IF ioCode <> 0 THEN SrcFileError(ioCode)
      ELSE
        BEGIN
          ($I-) Rewrite(DstFile, 1); ($I+)
          ioCode := IOResult;
          IF ioCode <> 0 THEN DstFileError(ioCode)
          ELSE
            BEGIN
              DiskFull := False;
              WHILE (NOT EoF(SrcFile)) AND (NOT DiskFull) DO
                BEGIN
                  (* Note fourth parameter in "blockread". *)
                  ($I-)
                  BlockRead(SrcFile, Buffer, BufSize, RecsRead);
                  ($I+)
                  ioCode := IOResult;
                  IF ioCode <> 0 THEN
                    BEGIN
                      SrcFileError(ioCode);
                      DiskFull := True
                    END
                  ELSE
                    BEGIN
                      ($I-)
                      BlockWrite(DstFile, Buffer, RecsRead);
                      ($I+)
                      ioCode := IOResult;
                      IF ioCode <> 0 THEN
                        BEGIN
                          DstFileError(ioCode);
                          DiskFull := True
                        END
                    END;
                END;
              IF NOT DiskFull THEN Writeln('File copied.')
            END;
          Close(DstFile)
        END;
      Close(SrcFile)
    END
  ELSE Writeln(#7, 'File can not be copied onto itself.');
END.
```

Fig 23 An improved version of the COPY.PAS program with built-in error checking

```
PROGRAM Delete;                                          ELSE WriteLn('Unknown I/O error.');
                                                       END;
VAR                                                  END;
  ioCode : Byte;
  FileVar : FILE;                                   BEGIN
  FileName : STRING[255];                             Write('Delete file : ');
                                                      ReadLn(FileName);
  PROCEDURE ioError(ioCode : Byte);                   Assign(FileVar, FileName);
  BEGIN                                               ($I-) Erase(FileVar);          ($I+)
    Write(#7, 'I/O result of ', ioCode, ' (decimal) ', #26, ' ');  ioCode := IOResult;
    CASE ioCode OF                                    IF ioCode <> 0 THEN ioError(ioCode)
      $01 : WriteLn('Filename not found.');           ELSE WriteLn('File deleted.')
      $20 : WriteLn('Illegal operation for a logical device.');  END.
      $F3 : WriteLn('Too many files open.');
```

Fig 24 A better way to delete any file without leaving the Turbo editor

capability. If Alt-Z means 'Zoom two times', then Alt-Z-Z could mean 'Zoom four times', and Alt-Z-Z-Z could mean 'Zoom eight times', and so forth.

FNGetKey$ is a QuickBASIC function that implements this scheme (Fig 22). It works like INKEY$, but it returns an extra character containing a repeat count for selected combinations of keystrokes using Ctrl or Alt.
J Parsly

As with Inkey$, you would use the length of the string returned to determine if the key that was pressed was normal, extended, or repeated. Some text editors, such as SideKick, use a similar technique to avoid repeatedly updating the screen.

If you press and hold Ctrl-PgUp in SideKick, it senses that you want to span several screens and waits until you stop key pressing. Then, it redraws the screen only once.

This function can be converted to work with Turbo Basic without much effort. Turbo Basic supports calling DOS and BIOS interrupts directly — RH.

Word counting

Here's an easy way to obtain an estimated word count for a Mac Word document.

Make sure the insertion point is at the top of the document. Access Change from the Search menu. Type in ^32 in the Find What box, and ^32 in the Change to box. Or simply press the space bar in each box. Click Change All. In a few moments the number of changes made appears in the lower left of the window. This yields a good approximation of the number of words in the document. And since you are changing white spaces into white spaces, you are, in effect, not making any changes at all.

You run no risk of harming all your work. The only problem arises with long files: if you are short on memory, Word may not be able to complete the procedure. Also, if your words are separated by tabs or returns (as in a long list of words), this technique won't work well.
J Mowreader

Copying and deleting in Turbo Pascal

Mr David Johns gave examples of some useful programs in TJ's Workshop, May 1987. His Copy and Delete programs worked well, but I found them inadequate. I've developed versions with runtime error checking and a display of what occurred during their execution. The programs are listed in Figs 23 and 24.

When I want to use one of these programs, I $Include it at the top of the program I'm working on, for example, {$IC:\TURBO\COPY.PAS}. Including the program is much cleaner than copying it into my current program and deleting it when I'm finished. It's easy to remove the single $Include line.
R Christopher

Clever! Turbo Pascal stops compiling when it reaches a legitimate 'END.' statement, e... · if it's in an $Include file. Hence you can $Include a whole program at the top of the program you're working on — NR.

```
{$R+}                                                   END;
PROGRAM GetASCII;                                        P := Succ(Pend);
CONST                                                  END
  buffsize = 16384;                                    ELSE P := Succ(P);
TYPE                                                   UNTIL (P >= top);
  BuffType = ARRAY[1..buffsize] OF Char;             END;
VAR
  FilVar   : FILE;
  Filename : STRING[64];                             BEGIN
  Actual   : Integer;                                  FillChar(ASCII, SizeOf(ASCII), False);
  MinLen   : Byte;                                     FillChar(ASCII[#32], 96, True);
  buffer   : BuffType;                                (* Now for any character CH, ASCII[CH] is true *)
  ASCII    : ARRAY[Char] OF Boolean;                  (* only if CH is a charcter from #32 to #127  *)
  overlap  : Byte;                                     Write('Enter minimum string length to check for : ');
                                                       ReadLn(MinLen);
  PROCEDURE Check(VAR B : BuffType; top : Integer; VAR OvLap : Byte);  Write('Enter name of file to check: ');
  VAR P, Pend, i : Integer;                            ReadLn(Filename);
  BEGIN                                                Assign(FilVar, Filename);
    P := 1;                                            Reset(FilVar, 1);
    OvLap := 0;                                        WHILE NOT EoF(FilVar) DO
    REPEAT                                             BEGIN
      IF ASCII[B[P]] THEN                                BlockRead(FilVar, buffer, buffsize, Actual);
        BEGIN                                            Check(buffer, Actual, overlap);
          Pend := P;                                     (* Back up to get any that "cross" into the next buffer *)
          REPEAT                                         IF (Actual = buffsize) AND (overlap > 0) THEN
            Pend := Succ(Pend)                             Seek(FilVar, FilePos(FilVar)-overlap);
          UNTIL (NOT ASCII[B[Pend]]) OR (Pend = top);  (* NOTE: This is a Turbo Pascal 4.0 program, but you can
          IF ((Pend = top) AND ASCII[B[Pend]]) THEN         convert it for TP3 by deleting the line above
            OvLap := Succ(Pend-P)                           and replacing it with the line below. *)
        ELSE                                            (* LongSeek(FilVar, LongFilePos(FilVar)-overlap); *)
          IF Succ(Pend-P) >= MinLen THEN                END;
            BEGIN                                      Close(FilVar);
              FOR i := P TO Pred(Pend) DO Write(B[i]); END.
              WriteLn;
```

Fig 25 An easy way to find ASCII strings in a .COM or .EXE file

Finding ASCII text in .EXE or .COM files in Turbo Pascal

Here is a simple Turbo Pascal program, listed in Fig 25, which you can use to find any ASCII text in an .EXE or a .COM file. I use it to see all the messages a program prints to the screen and to look through programs obtained from bulletin boards for any messages that may indicate a 'bomb' program (although this is not always a foolproof method).
M McGuffey

The original program simply printed out every printable character in the source file. I enhanced it a bit to let you choose a minimum length for the strings you'll see. The program puts each string of at least the minimum length on a separate line. If you see 'Arf! Arf! Gotcha!' in the output, think twice before running the program. Note that the program doesn't check for existence of the input file — bad filenames will crash it — NR.

Ready,Set,Go! 4.0

Ready,Set,Go! 4.0 has no way to generate a table of contents (TOC) automatically. Here's a fairly simple way to create a TOC that will stay current even as you change the document.

Create a text block on the page where you want the table of contents. Be sure that the block is only large enough to hold the one entry and the page number. Enter the text for the entry and then press Command-Option-Shift-7 where you want the page number to go. The symbol '&&' will appear, which is RSG!'s way of saying 'text continues on' — something mentioned only on page 201 of the 'Reference Shortcuts' documentation. Create similar blocks for each TOC entry.

Now use the linking tool to link each TOC entry to the target page text block. The TOC entry should now show the page number of the article or chapter. And it will be updated even if you add or delete pages.

This technique requires that you carefully pre-plan your document and create approximate text blocks for each item to be included in the table of contents. But it will still save you time and a lot of headaches.
J Buono

END

Will you be working with an alien network?

Or one that's more down to earth?

New Sage MainLan. There's simply no alternative.

For the 100th issue of APC, we asked a number of self-confessed games junkies to report on their all-time favourite computer games.

A Mind Forever Voyaging

The poet William Wordsworth must have been greatly moved as he gazed upon the statue of Sir Isaac Newton, the world's greatest mathematician and physicist. Before the day had faded, he wrote of the statue, 'the marble index of a mind forever voyaging through strange seas of thought alone . . .'

Newton could hardly visualise the future, but he certainly helped shape it. Only a mind so free of prejudgment and day-to-day assumptions could ponder such thoughts as to why an object should fall to the ground rather than rise to the sky. In A Mind Forever Voyaging, such qualities (on a much lower level, of course) are needed. It is the qualities of

the unknown and the untested which makes it such a bold, outstanding game.

As Perry Sim, you must venture into the future with the lingering memory of a frightening disclosure: you have just discovered you are a computer. The life you have led — or thought you had led — as husband, father and writer, has been a miracle of artificial intelligence. You have now been programmed with the latest government plan for the future well-being of your country.

A Mind Forever Voyaging is as broad as it is sweeping. The game is not so much involved in the solving of puzzles as in the making of decisions and reporting back events as you interpret them. It is a complex game and it would be unfair to say it

is for the beginner. This one is a must for the competent player only.
G Hampson

Carmen Sandiego

Education has always been an important reason for purchasing an Apple computer. However, if one didn't have the appropriate software, all was wasted. 'Where In The World Is Carmen Sandiego' was one of the best educational games ever to be released. For an educational program to be successful, it must be entertaining as well as informative. Carmen Sandiego is both.

The overall plot is to capture a perpetrator of some terrible crime (such as stealing the Crown Jewels). With a user interface that is simplicity itself, one journeys from city to city seeking clues to the criminal's identity. For example, on arriving in Sydney, an airline official might say that he saw a man with red hair asking which way the museum was. Following him to the museum might provide another clue. When you think you have enough clues, a visit to the crime computer is arranged. If identification is successful, a warrant for the arrest of the culprit is issued. This enables an arrest to be made once the bandit has been cornered. If, upon visiting a particular city, the bandit is not apprehended nor any clues given to his whereabouts, one then has to back-track to a previous location and try to pick up a stale lead. The only problem with this is that a time limit in which the crime must be solved is always set.

The program was so successful for Broderbund that it released another two scenarios: 'Where In The USA Is Carmen Sandiego' and 'Where In Europe Is Carmen Sandiego'. The USA program has questions that are more appropriate to students of that country, and although I have not seen the European version that may well be the same. It would be great if they would release an Aussie version!

Overall, this program is a winner, because it is easy to get into, is excellent educational value and overall, very entertaining.
J Paske

Arctic Fox

In choosing a game which deserves recognition as a real breakthrough in computer entertainment, the criterion in my book is 'will I still be playing it in a year from now?'.

One of the first truly great arcade games to be written for the Amiga was Arctic Fox by Electronic Arts. I played it regularly for well over six-months — and it is still one of my favourites after more than two years. As commander of the world's most advanced tank, you have at your disposal canon shells, mines and guided missiles to help in the fight against an alien invasion force which has put a force field around the Arctic regions. Enemy tanks, aircraft and floating mines are just a few of the hazards encountered as you make your way deep into enemy lines to destroy their fortress.

The joy of Arctic Fox is not just in destroying the enemy, but also in mastering the awesome potential of the machine at your command and recognising its limitations. Planning and strategy are called for throughout the game, ranging from a choice of best typographical positioning to simple hide-and-seek. Use of the tank's radar is absolute-

Leather Goddesses can be tame, suggestive or lewd, depending on which mode of play is selected. Naturally, everybody plays in lewd mode. Much of the fun is derived from the po-faced seriousness of the characters in even the most comical situations. Tiffany may

be voluptuous, but she sure ain't bright — a trait you will come to love.

Most of the outrageous scenes are written somewhat tongue in cheek. The spaceship is a 'potent-looking battleship with two pendulous, brimming fuel-tanks' — or what psychiatrists are apt to call a phallic symbol. Frankly, it looked remarkably like a penis to me . . .

G Hampson

Lode Runner

Back in 1983, a game most Apple owners were playing was Lode Runner. The power hungry leaders of the Bungeling Empire have pillaged a fortune in gold from the people by means of excessive fast food taxes. Your mission is to raid each of the 150 treasure vaults and recover as much booty as possible.

This is not an easy task, what with Bungeling guards and the ever present trap-door. However, with a keen eye and a reasonable joystick, the early levels (er . . . treasure vaults) are not all that hard. The real hassle comes when, after playing for three hours and attaining level 39, you are called to dinner. In order to sustain enough energy to manipulate a joystick, one has to eat, so switching off the machine is almost inevitable.

You see, in those good old days, saving the game was not part of the program.

It is so absorbing, with its ladders and hand over hand bars, that many an hour is spent trying to improve previous scores. Initially, you start on level one with five men, and for each completed level one extra man is added.

If you are having trouble with a particular

level, you can enter the cheat mode, giving yourself unlimited men to practise with. If you complete the 150 levels, there are two alternatives: firstly, purchase the scenario Championship Lode Runner (a much harder game); or secondly, make your own levels using the game editor.

Lode Runner is a good package, for not only does it contain an addictive game but also an excellent editor, with which you can create your own levels. This program is enjoyed by many Apple owners because it is easy to learn, absorbing to play and inexpensive.

J Paske

Mean 18

'And as Greg Norman lines up this 35ft putt for an eagle, a hush falls over the gallery'. This summer there will be a lot of golf played on Australian courses, and while it is not quite the same as playing the real thing, there are several golf games you can play on computer. The best I've come across is Mean 18 for the Apple.

Mean 18 from Accolade first appeared on a 3.5in disk, which contained three courses. An extremely useful module also included is the Architect facility.

With the aid of the Architect you can design your own courses, right down to the slope of each individual green. In this manner you can construct your local links, then practise at will your favourite holes. Playing the game is a breeze, and up to four players can participate using either regular or professional tees. Mean 18 can be played using the expert level, and while this is slightly harder, both levels are fairly easy.

If you want to brush-up on your game there is a practice tee, green and hole. The realistic sounds of the GS machine come to the fore (pardon the pun) with simulated effects such as hitting the ball, sinking a putt and gallery applause for a good shot.

The popularity of Mean 18 can be gauged by the number of courses that computer golfers have created. The Sydney Apple Users Group, for example, has a large number available on library disks for a reasonable price to members. Mean 18 as a golf simulation is second to none.
J Paske

Phantasie III

Phantasie III is a computer-controlled role playing game, set up similarly to Dungeons and Dragons. You control a group of six adventurers out to save their world from destruction. To accomplish this, they must find and defeat the evil sorcerer, Nikademis. This entails searching through an entire continent, two alternative planes and eight dungeons scattered throughout the land and elsewhere. This is not as straightforward as it may seem, as the dungeons are heavily populated with various traps, monsters and puzzles, all of which must be overcome.

Play of the game is with a mouse and/or keyboard, but I prefer a combination of the two. Battle sequences are well done except for the spell casting, which the monsters do not use effective-

ly. The continent is very large and well spread out, the dungeons are deadly and the save feature on each is a necessity. Remember to thoroughly explore each dungeon.

Phantasie III has been well designed and should keep any game player actively employed for many hours trying to finish the quest. The graphics are excellent, with some of the best designed monsters I've ever encountered, but the animation sequences are almost non existent. (When will people learn how to port programs to the Amiga?)

All in all, an excellent game for role players, but anybody else would probably find the time taken to finish it too long.
K Currie

Shanghai

Every once in a while, a game comes along that is such a challenge to play and so entertaining at every turn, that it takes an honoured place in the disk storage-box. Shanghai is such a game; a perfect example of how a 3-D boardgame can be transported to a 2-D computer screen. Shanghai is immediately and permanently addictive. It is clever, easy to learn and beautifully presented. For years, I have encouraged my wife to play computer games (in the

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hope that I could see her more often), and I finally managed it with Shanghai.

One of many derivatives of the ancient game of mah-jong, Shanghai is played by removing matching pairs of mah-jong tiles until there are none left. As in any game involving a random spread of pieces, there is bound to be an element of luck, but strategy reduces this to a minimum. Careful thought and planning while removing pieces from play will bring its own rewards. Non-completed games can be saved to disk as well as resident games called to the screen.

The game can be played solo or in pairs and at Ordinary or Challenge level. At Challenge level, the player can select a pre-set time in which his partner must make a move before a gong indicates the turn of the other player. In this mode, it is deceptively exciting.

I first played Shanghai in 1977 and, with luck, I'll still be playing it in the year 2000. Come to think of it, I think I'll play it now . . .

G Hampson

Zork

Far better writers than I have put pen to paper to wax lyrical over Zork, the world's biggest-ever selling computer game. Incredible, unbelievable, terrific, stupendous — every superlative you can think of has been used to describe the unique atmosphere of this game and the cleverness of the puzzles encountered on the long, arduous journey through the Great Underground Empire.

Like a precious jewel designed to draw gasps of admiration from the throng, Zork is a masterpiece of craftsmanship against which all other games are measured. No-one, past or present, has equalled this outstanding game — and in this writer's opinion, no-one ever will.

In the true sense of the word, Zork is a classic within the adventure genre and was almost certainly written under the influence of J.R.R. Tolkien, author of 'The Hobbit' and 'Lord of the Rings'. The treasures, the troll, the thief — and in the later Zork releases which form the trilogy — the fire-breathing dragon and the virgin princess are just some of the things you will encounter.
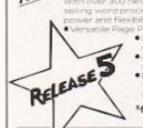
The mailbox west of the house must be the most famous mailbox in history and the house itself has become a welcome beacon for all hardy adventurers. Here the quest begins and the sword is at hand. You will marvel at how easily it fits your grip and how quickly you master its power. You will need it before the day is done.

Zork is timeless and rich in wonder. It will ever remain that perfect creation for the child within us who yearns for excitement and the discovery of treasures unimaginable.

G Hampson

END

"Who's got the computer with the slow response time?"

LAZING AROUND

Brainteasers courtesy of JJ Clessa

Quickie

"I want three gins please," said the customer. "Two of them with tonic, two with a slice of lemon, and two with ice, but none with all three." If you were the barperson, what would you have done? (The answer is not 'faint'.)

Prize puzzle

For this problem you will need to find the most frequently-occurring quotient that results when a five-digit number divides exactly by the sum of its digits. For example, 82030 divides exactly by 13

(8+2+0+3+0) to give a quotient of 6310; 63100 divides exactly by 10 (6+3+1+0) to give the same quotient, and so on. Which is the most frequently occurring quotient?

Answers on postcards or backs of envelopes to arrive not later than January 13, 1989.

Send your entries to: Lazing Around December, APC, 124 Castlereagh Street, Sydney 2000.

September prize puzzle

A good response — over 65 entries — indicating that the problem wasn't too difficult. However, many entrants got it wrong since they failed to realise that the first missing page number must be odd (it must be a right hand page) and similarly the last missing page must be even.

There is therefore only one solution: pages 35-90 inclusive. The winner chosen at random was Mr R Glass of Geraldston, WA, who receives congratulations now and a prize shortly.

Now to the four 7s. We have another solution which, although unacceptable, is worthy of publication. It was sent in by Mr Dajani. (77)°F + (7/7)°C = 26°C. A nice try, don't you think?

END

NUMBERS

Mike Mudge explains a persistence property of the positive integers resulting from the addition of their prime factors.

The problem to be investigated this month has been suggested by Paul Cleary.

It is well known that any given positive integer can be uniquely represented as a product of prime factors. Having carried out this factorisation, the resulting factors are added to generate another positive integer and the process is then repeated.

For example, $117780 = 2 \times 2 \times 3 \times 5 \times 13 \times 151$; the sum of these factors is $176 = 2 \times 2 \times 2 \times 2 \times 11$; the sum of these factors is 19, which being a prime number will reduce no further.

Now, if the positive integers from 2 onwards are subjected to the above iterative process, it becomes clear that very many reduce to 5, that is, the sum of the two smallest prime numbers 2 and 3.

For example, $148980 = 2 \times 2 \times 3 \times 5 \times 13 \times 191$ yielding $216 = 2 \times 2 \times 2 \times 3 \times 3 \times 3$, yielding $15 = 5 \times 3$ and in turn $8 = 2 \times 2 \times 2$, finally $6 = 3 \times 2$ hence 5.

Note The prime numbers themselves reduce no further under this procedure, so are omitted from consideration.

Paul Cleary has listed all the positive integers less than 10001 which reduce to 5 and has noted the occurrence in his list of a number of consecutive sequences (for example, 800, 801, 802, 803, 804) together with a 'sprinkling' of palindromes (such as 444, 484, 959).

Problem I Implement the above itera-

tive procedure and examine in particular the sets of positive integers which reduce to prime numbers other than 5. In passing, it would be valuable to note the distribution of the persistence of the positive integers under this procedure, that is, the number of iterations needed to reach a prime number. This $p(117780) = 2$ while $p(148980) = 5$ from the above examples.

Problem Ia Repeat the above investigation but neglect the multiplicity of the prime factors, that is, add each distinct prime factor once only to obtain the positive integer for use at the next stage.

Problem II Consider an iterative procedure involving the sum of the squares (or indeed any other positive integer power) of the prime factors.

Note Careful consideration must be given to the question of the convergence (or termination) of the procedure for higher powers!

Problem IIa As II, but again neglecting multiplicities.

Readers are invited to send their attempts at some or all of these problems to Mike Mudge, C/- APC, 124 Castlereagh Street, Sydney 2000, to arrive by January 1, 1989. It would be appreciated if such submissions contained a brief description of the programs and a summary of the results obtained in a form suitable for publication in APC.

Review: June

Submissions relating to this problem — squares of nonconsecutive integers giving rise to difference tables having constant second differences — contained a considerable variety of material, ranging from almost random experimentation to very sophisticated algebraic analysis.

However, the prizewinner this month is Robin Merson. Robin's submission extends to 15-plus pages of algebraic analysis together with extensive programming of his 'rapidly getting obsolescent' Apple II (indeed, the associated Epson 80MX printer 'gave up' part-way through the investigation).

Related reading

The attention of number theory enthusiasts is drawn to the recent publication of 'Elementary Theory of Numbers' by W Sierpinski, editor A Schinzel, from North Holland Mathematical Library. This is the second, revised and enlarged English edition, of 1988. ISBN 0-444-86662-0, 513 pages in hardback only.

END

Mike Mudge *welcomes correspondence on any subject within the areas of number theory and other computational mathematics. Particularly welcome are suggestions, either general or specific, for future Numbers articles. All letters will be answered in due course.*

DIARY DATA

DIARY DATA

26-28 **QLD Office and Equipment Expo** This fifth office and equipment expo to be held at the RNA Showgrounds will have everything from facsimiles to filing systems, typewriters to word processors, computers and paging systems. *Enquiries, QES, tel: (07) 273 4066*

27-29 **Computer '89** The Perth Entertainment Centre is the place to be for WA's most popular computer exhibition. *Enquiries, Swan Exhibitions, tel: (09) 443 3400*

May

30 **Comsoft '89** Comsoft '89 will be held over a period of three days at the Hilton International, Adelaide. This exhibition exclusively covers business software for minis and PCs. *Enquiries, Ray Goldie, tel: (08) 274 3720*

June

6-9 **PC '89 and Office Technology '89 Melbourne** This combined exhibition also includes Communications '89. All three will be held at the Royal Exhibition Buildings in Melbourne. *Enquiries, AES, tel: (03) 267 4500*

23-25 **Queensland Electronics Show** The show is expected to have over 100 exhibitors promoting a range of products including video recorders, PA systems, compact discs, video laser discs, cameras, printers and even microwaves! *Enquiries, QES, tel: (07) 273 4066*

July

10-14 **Ausgraph '89** Darling Harbour is the place to be for Ausgraph '89. This is Australia's only specialist conference and exhibition on computer graphics covering all major applications of the technology. *Enquiries, Robyn Hughes, tel: (03) 387 9955*

August

1-3 **Comdex '89** Professional end-users and resellers will have the opportunity to meet, learn and exchange ideas with other like-minded professionals at this exhibition at Sydney's Darling Harbour. *Enquiries, TIG Australia, tel: (02) 959 5555*

1-9 **Comtec '89** To be held at the Morphetville Function Centre, Adelaide, this trade exhibition displays a comprehensive range of computer and business equipment. *Enquiries, Ray Goldie, tel: (08) 274 3720*

September

12-15 **IREECON '89** This exhibition to be held in Melbourne will host a substantial trade-only electronics display as well as a series of lectures covering the release of new technology and research developments. *Enquiries, IREE, tel: (02) 327 4822*

DIARY DATA

20-22 ACE '89 This major computer industry exhibition will once again be staged at Darling Harbour. All the latest in computer technology and productivity will be displayed for the benefit of all users. *Enquiries, ACP Exhibitions, tel: (02) 264 5337*

20-23 Business Horizons This exhibition, to be held in Brisbane, covers everything from computer technology, business services and office equipment to fleet management and marketeering. A comprehensive show for all. *Enquiries, XPO Exhibitions, tel: (02) 411 8004*

November

2-4 MacWorld '89 MacWorld '89 will be bigger and better than ever. The exhibition will once again be held at Darling Harbour. *Enquiries, TIG Australia, tel: (02) 959 5555*

8-11 QLD Computer Expo '89 This show, to be held at the RNA showgrounds, is attended by businesspeople and the general public alike and is the perfect arena to make important decisions on purchasing software and hardware. *Enquiries, QES, tel: (07) 273 4066*

23-25 Telecom ISDN Service in Australia Exhibition Communications managers will benefit from this exhibition to be held in Melbourne at the Dallas Brooks Centre. Discover the latest ISDN technology and its business applications. *Enquiries, Anne Grant, tel: (03) 606 8895*

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Stephen, Philip and
all, please note:
Following may be
worth dissectins.

```
X & Y random, N increaases
10 X = INT (RND*50) : BEEP
15 IF X<2 THEN 10
20 Y = INT (RND*(X-1))
25 IF Y=0 THEN 10
30 FOR N=2 TO 30
35 IF X^N>1e10 THEN 10
40 E=1 : B=X-Y: C=X^(N-1)
45 T=C : A=X^N-Y^N
50 CLS : PRINT X;Y;N,C;
55 D=C*Y/X:E=E+1
60 PRINT "+";D;:T=T+D
65 IF E=N THEN 75
70 C=D:GOTO 55
75 PRINT "=";T:REM =A/B
80 FOR K=1 TO 200:NEXT K
90 NEXT N: ..CASIO,PB-700
```
Merit reinstatement?PB-80
dead, files lost. New Address
possible, but PO Box 479 Gos-
nells WA 6110 Always OK.
Terry Perce.

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